

21°C

PREVIEWS OF A CHANGING WORLD

THE FUTURISTS

MAKING TOMORROW WORK TODAY

Gareth Evans
on Australia's
place in Asia

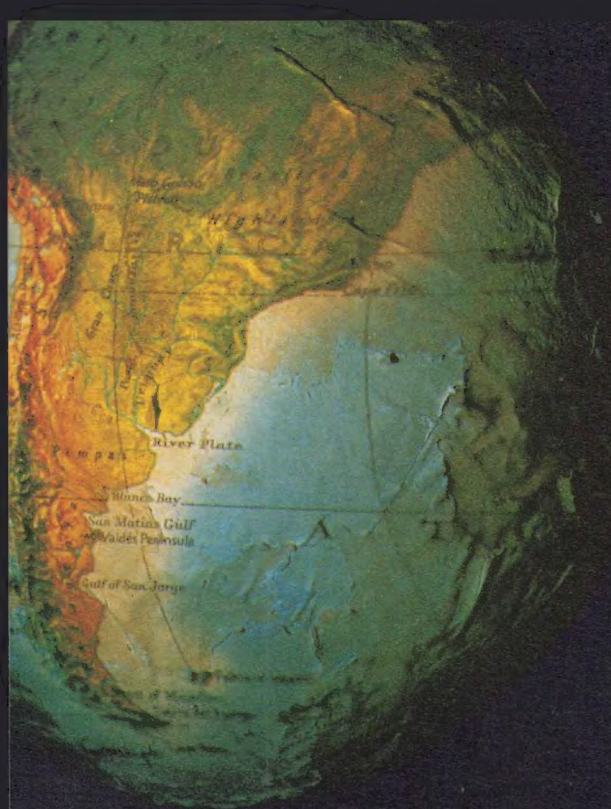
The Commission
for the Future
reports on the
Asian answer to
superannuation

TECHNOFEAR

THE TERMINATOR TRAUMA



Quantum



The read of your life



In this age of rapid change, keeping pace with new ideas is essential. **21•C**, the magazine of **THE COMMISSION FOR THE FUTURE**, previews a changing world.

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Barry Jones



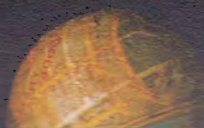
Robyn Williams

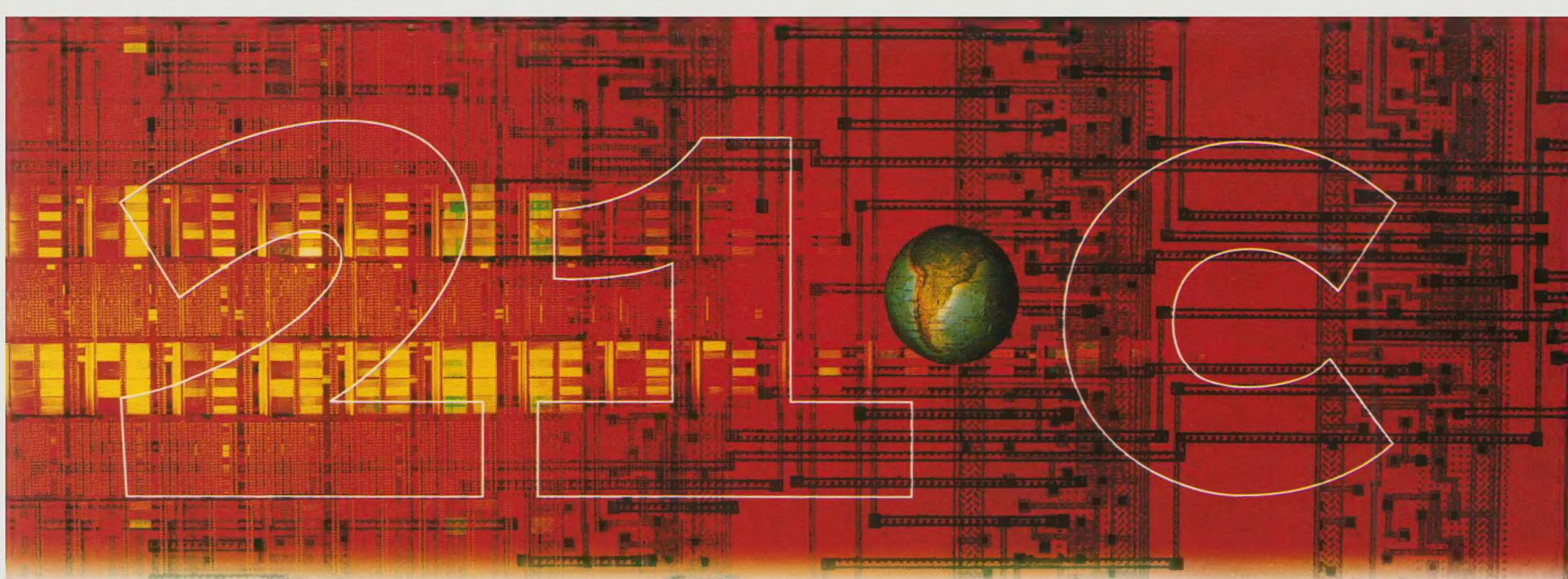


Margaret Whelan



David Dale





How do we see the future?

ONCE, IN A SUPERSTITIOUS AGE, it was the work of sorcerers, wizards and witch doctors, shamans and seers. Wise men throughout every tribe, every medieval society. They maintained their authority by predicting the actions of the gods, a hazardous role because they had to interpret the data – signs in nature, human traits – and convince their societies that the gods would act in the pronounced fashion.

Over the years, alchemists, astrologers and mathematicians refined the art, gathering stronger information to cast their predictions. But only now, within what Marshall McLuhan described as the global village, is the information at hand world-wide. And with such information has come the pragmatic realisation that prediction is not only hazardous for those predicting, but dangerous on many other levels. However, from this tradition has grown an alternative: the careful study of futures, and the potential of considered advice for the road of the future.

True to its brief, considering strategies for the future, *21•C* in this edition profiles pre-eminent figures who have made a career from contemplating the future and, through their advice to industry, government and commerce, are helping to shape decisions and policies which will lead to a safer – and more productive – future.

To do this, *21•C* enlisted the assistance of the editor of the authoritative British journal *Futures*, Clare Degenhardt. Clare took up the challenge with energy and enthusiasm, profiling some of the major figures in the field; Eleanora Masini, Martha Garret, Ian Miles, Michel Godet and Christine McNulty. In Australia, The Commission For The Future was lucky to snare the visiting Italian futurist James Ruscoe and to profile Melbourne-based futurist Rick Slaughter. The range of interests pursued by these key futurists reflects the significance of their studies. They come from around the globe, reflecting the international importance of such studies, and cover the varied realms of economics, environment, science, politics, technology, education and the arts [page 36].

This feature is timely, following closely from the recent international futures conference in Barcelona. Our vision of the future is in a constant state of flux, and as such reflects the nature of the present. It is not so long ago that the future included the bleak prospect of a Cold War maintained by nuclear deadlock. Technology had an element of threat (partially dispersed by the introduction of home computers which are gradually becoming as common as video recorders). The culture reflected this bleak lead, seen specifically in the cinematic vision of such films as *Bladerunner*, *Terminator* and *Robocop*. The changes in our culture reflect those of our society – the second *Robocop* film has the man-machine overcome his evil programming and the second *Terminator* has its star, Arnold Schwarzenegger as a good cyborg. *21•C* commissioned Sydney cultural commentator McKenzie Wark to contemplate the cultural reflection of Techno-Fear. Says Wark: "Tech Noir gives us stories through which we can grapple with this complex state of affairs, our (in)human condition." [page 50.]

At the Barcelona Futures Conference, *21•C* was greeted as unique world-wide in its potential to introduce to a broad public the potential of futures studies and international issues relating to the future. The new editor of *21•C*, Ashley Crawford, has brought together the vital elements of this issue. We hope that our readers around the globe find *21•C* increasingly challenging and enjoyable.

SUSAN OLIVER,
Managing Director, Australian Commission for the Future



SUSAN OLIVER



ASHLEY
CRAWFORD

21•C

C O N T E N T S

GET HIP TO A NEW LINGO

Do yourself an *ageru* (tomorrow's nuspeak for favour). As we adopt fresh words and junk old ones, the single certainty is that English will never be quite the same. Writer Stephen Knight boots up the nudictionary for the orientation download. **PAGE 6**

THE ASIAN ADVENTURE

Australia is poised to benefit from its special relationship with Asia. Foreign Minister Gareth Evans explains how the best advantages can be won from the challenging economic dynamism of the region. **PAGE 16**

THE FUTURISTS

"The future – it is not a science, it's an attitude." Futurist Michel Godet, along with seven prominent international futurists, tells 21•C how individuals and nations can best use the future. A special report by Clare Degenhardt and Ashley Crawford. **PAGE 36**

TECH IT OUT

Even the most escapist of movie genres, science fiction, is very much connected to everyday problems of the experience of technology. Indeed, escapist movies work precisely by providing imaginary solutions to very real problems says McKenzie Wark. **PAGE 50**

FORECASTERS OF FATE

Life's a risky business; being eaten by a shark, having six children, living to be 105, the odds can be calculated on almost any event. These days, the unexpected can prove so expensive that many businesses no longer take chances with chance says Griff Clemens. **PAGE 54**

THE GREAT AUSTRALIAN BLIGHT

Tourism means money. But as our pursuit of relaxation and the tourist dollar increases, so does the destruction of our natural and cultural heritage. Gary Walsh assesses the damage. **PAGE 60**

THE CAMERA: FROM DAGUERRETYPE TO SATELLITE

The rocket hits in Bagdad. The camera snaps and, with barely a moment passed, the image is being analysed by George Bush sitting in the Oval Office. No film, no developing. The future of the camera, and of its images, is undergoing a revolution, reports Margot O'Neill. **PAGE 67**

THE SUPER SINGAPORE SYSTEM

From now on, superannuation will be an integral part of financial planning for most Australians – but can the Government come up with a system that works? Economist Daryl Dixon says that Singapore holds the answer. **PAGE 74**

DIVING INTO DATALIFE

From Cyberpunk fantasies, to video arcades, to a potential communications revolution, the world of virtual reality represents a radical technological potential – where imagination meets the computer. Quantum's Richard Smith dives into datalife. **PAGE 78**

THE NEW REPUBLIC

The publisher of the *Women's Weekly* and *The Bulletin* is calling for change. Richard Walsh believes now is the time for an elected President with an appointed Cabinet. Terry Lane hears the plan. **PAGE 84**

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RECYCLING

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A splash hit: This pool of chocolate, with myriad drops, was created by the Video Paintbrush Company on computer because it would have been difficult – and too expensive – to photograph. 21•C features Virtual Reality, and the dramatic changes coming in still photography, in this issue.

21•C is a quarterly publication produced by the Australian Commission for the Future Ltd. Part of its role is to encourage discussion and thinking about long-term trends and to communicate options for the future to decision makers and the public.

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Brave new world, Brazen new words

A global language looms which will be a linguist's nightmare. For the person on the street it will be English as usual. 21•C gets hip to the new lingo.

BY STEPHEN KNIGHT

LIKE AIR, language is all around us: both keep changing, however little we notice variations. Listen to a very old person speak and you can hear how far language might move in one lifetime. Where, we might nervously wonder, will it travel under our own feet, and into the next century?

Insidious change surrounds us. Australians of all ages now, like Americans, stress the first syllable of *address*, *research*, *resource*. Terms like *sushi*, *futon*, *tsunami* are imported from Japan. New idioms consistently emerge: "tired and emotional" for inebriated, "bottom of the harbour", a doubtful tax scheme, "state of the art", anything technologically up-to-date. The Macquarie Dictionary's *New Words* volume has 3000 entries since the early '80s, sweeping from *ageism* to *zero option* and full of lively youth words, *dork*, *dub*, *wacko* and *westie* or technospeakisms like *baud*, *meg* or *zydeco* (two computer terms and a kind of music). All these have just arrived. To be true to pronunciation let's call them Jusswords.

While we enjoy novelty in clothes and cars and practically demand it in culture and convenience, the thought of verbal innovation alarms most adults, as if the bases of their world were shifting. What happened to the English of Shakespeare, anxious novophobes will ask? Usually in newspaper columns.

It never stopped changing is the only answer, and W. S. of Stratford was part of it. Not only did he spell his name three different ways, he introduced new words; like *dislocate*, *obscene*, *portent* and idiomatic phrases such as "*a very palpable hit*", "*tongue-tied*", "*short shrift*", "*cold comfort*" and even a touch of Latin in "*Et tu Brute*".

What seems normal and correct today was once an unpleasant innovation. Samuel Taylor Coleridge, poet and partial radical, attacked the revolutionary American word *talented*. Later Yankee emigrants who never went home were *commuter*, *notify*, *scientist*, *hangover*. How could we do without them, or what they signify?

The shifts of history can, with some foolhardy courage, be projected into the future. In language change, politics plays a major role. We have *veal* from a calf and *beef* from the cow; the

COMPUTER ILLUSTRATIONS BY IAN HAIGH CARTOONS BY ANDREW DYSON

WADAD

WADAD

WADAD

WADAD



hombre - really
macho man



DUCTILE HOMBRE

ductile -
easily led

first in each pair, the restaurant word is French, the second down on the farm Anglo-Saxon. The Norman lords gave Gallic dignity to meat on its debut at their French-speaking table.

In our time, American English has similar force. Business brings dubious gifts like *junk bonds* and *checkout*; war wears euphemising clothes – *escalate*, *defoliate* for Vietnam's offensive on people and trees, and now, after the Gulf, *collateral damage* is civilian death. In politics and sport, Nixon's *plumbers* and basketball's *slam-dunk* are new ways of blitzing the bad guys.

These patterns will surely continue, though their forms may alter as America undergoes change. Nearly a third of its people speak Spanish; they are on an upward path, and the pan-American market gives their language great prospects. Hispanic will fill the place played in the past by Jewish and Afro-American. After *schlepping around* and *staying cool* all this time, we may begin to speak like a Tex-Mex *hombre*, whose enemies are *enemigos*, his neck and chillis equally *rioja*. Higher culture will also hispanicise. The new *Americanos* will be young and lively: fashion style may be *parasezo*, casual, or *guape*, pretty, and in music the heights of what was formerly funk or shtick will be known as *el sumamente mas*, barrio talk for the mostest. Hemingway's phrase for courage *muchos cojones* meaning big testicles, may prove to have legs as well.

Innovation will also flourish outside North America. Power is a sore corrupter of your allegedly pure language, whatever its source. Contemporary clout increasingly comes from Japan, though so far we are net lenders, in language at least, to these Northmen of the Pacific. You might in Tokyo recognise *nekutai*, for a necktie, if not the *sebiro* it goes with, a suit from, as they hear it, Saville Row.

But by next century Australians could owe as many words to Japan as we now do mortgages. There will be a need to understand *ainiku*, "unfortunately", and to know how to *ageru*, "do a favour for a superior". They may call us *bimbo*, which in our sad case means "poor"; *damaru*, "hold one's tongue", might be useful too. The word "to change money", *tsuri*, will hiss on hopeful lips, and by then we may be reading the *Sunday Shimbun*, the Nipponese for newspaper. Let's hope the folk in *shobai*, "trade", in that new *showa*, "era" so successfully *uru* ("sell") at the *tsukue* ("desk") that they generously *ageru* – "do a favour for an inferior". All these could be in next century's speech; we should call them Nexwords.

One thing looks plain: aesthetics will play no part in language in the 21st century, since power, not style, is the driving force of change. A language of elegance and fun like Hindi, in spite of many speakers and noble traditions, will provide no words. Much as we might enjoy knowing that winter is *shiit* to them and snow is just *barf*, we will probably never use such words, nor the Hindu's lovely polysyllables, where madam is addressed as *shriimatiijii* or wished good fortune through intoning *shubheechchhaa*. Those delightful choices won't come our way; their medium is too powerless.

Intimacy can be another word-conduit, as when Indian servants transmitted *curry* and *sahib* into English, though these words tend to be mishandled, like firm Malay *geduna*, a warehouse, which became *go-down* in Australia, Vietnamese will be a ground-level source, rather like Italian. *Mi* for noodles (or more usually *mee*) is already in use, and so soon may be *hoa*, a flower, the finely named *du du*, papaya and *hona* for persimmon. The friskier side of Vietnamese culture may

deathwacho -
disturbed
young
Australian
person

dub type of
alleged music

THE 21 • C SHORTER NUDICTIONARY

NEXwords

ageru - do favour for a superior (Jap.)
ainiku - unfortunately (Jap.)
amnese - to forget completely
askeying - speaking numerically
bimbo - Japanese for poor; American for woman with poor taste in men
catonic - too out of it to say catatonic
chao ong - so long (Viet.)
confrontion - short confrontation
damaru - hold one's tongue (Jap.)
dao - knife (Viet.)
disamellorate - get (and speak) worse than we can imagine
du du - papaya (Viet.)
enemigos - enemies to the new Hispanic world order
fasturtle - hurry, children
guape - pretty, like a senorita
hoa - flower (Viet.)
hombre - really macho man
hong - persimmon (Viet.)
insomn (verb) - to lack sleep, through worrying about our vocabulary
loop - repeat, like a compudork
mi - noodles (Viet.)
muchos cojones - vulnerable courage, as of a linguistic prophet
nudictionary - lexicon of innovative incomprehensibilities
ombudse - act on behalf of people, very slowly
orlention - direct attention in fashionable way
parasezo - lazily stylish, con sombrero
parturocapable - woman
paterocapable - man
penup - Stop, class!
recitive - singing a la mode
prize (verb transitive) - award money to literary lackey
rioja - red (of wine, neck or linguist's face)
Shimbun - newspaper, such as the Sydney Morning Herald or Showa (Jap.)
shobal - business (Jap.)
showa - era (Jap.)
el sumamente mas - the Hispanic mostest
treaty (verb transitive) - make frail international agreement
tsukue - desk (Jap.)
uru - sell (Jap.)

UPwords

androgyno - of dubious, perhaps unimportant gender
atavistic - ancient, back to our grandfathers
avatar - another form or phase, especially of gods or sportsmen

cachectic - weary, debilitated, as after writing an article
deponent - passive in form but actually full of action
ductile - easily led
hypnagogic - sleep inducing
inhibitor - person, thing or drug that constrains
insulse - unsalted, tasteless, stupid, but very healthy for you
interoceptive - internally stimulated, as of very safe sex
levin - lightning (or flashy London columnist)
orectic - of desire or appetite, as in orectic tissue
pathologising - giving painful physical form to emotion or feeling
presbyopia - the improving vision of old age
recondite - secret, little known, so treasured
rubricate - redden, annotate, give as instructions
serendipity - chance-discovered happiness, as in land of Serendip (honestly)
syndrome - set of phenomena or symptoms
tombac - Malayan copper-zinc alloy, as in mementoes of Australia
vortex - spiralling centre of power, or name of German-owned oil company

JUSSwords

adaption - a brief adaptation
ageism - suggesting years bring frailty
bad guys - hostile persons from America
baud - measurement of electron-speed, invention of baud guys
boot - to start a computer, or to kick a non-working computer
challenged - disabled person politely (and incomprehensibly) addressed
checkout - place where you realise you have more goods than money
collateral damage - American military term for mass murder
cremains - result of concealing mass murder with fire bombs
default - unnegatively normal in compuspeak
defoliate - military autumn, precedes nuclear winter
disempowered - unable to do anything (including make oneself understood)
dork - schoolyard numbskull
download - pass data from one system to another
dub - type of alleged music
escalate - heighten, especially systems of military mass murder
fax - electronic photocopying at a distance, way of spending a fortune on meaningless discourse

forex - systems for money-consuming intoxication by way of foreign exchange or beer
futon - Japanese transportable bed, way of sleeping on floor while not on floor.
glasnost - Soviet openness, if that's not a contradiction
junk bonds - mysterious way of deceiving people, including yourself
meg - computer speed measurement for which you pay till it megahertz
modem - computers' happy-talk system
perestroika - Russian restructuring, if not another contradiction in terms
plumbers - incompetent Watergate tradespersons
pomo - a tiny word for PostModernism, the genie with the dyed pink hair
skeggins - believe it or not, a skirt with leggings. Perhaps designed for huntin', shootin' and wishin'
slamdunk - way of scoring basket, occasionally of pulling down whole basket structure to immense delight of spectators and world-wide television
sushi - Japanese raw sliced fish a subtle revenge on the West
tsunami - Japanese for tidal wave, climatic equivalent of tourism
unplanned vacancy - another academic has starved to
deathwacho - disturbed young Australian person
westie - young Australian person not yet diagnosed as disturbed
whollistic - favourite word of those whose food is healthier than their spelling
zero option - removing all nuclear missiles; also phrase for how much choice we have about linguistic change
zydeco - another alleged form of music, could be dub played backwards

LOSSwords

alternate - every other, not optional other
beneficent - doing good, not advantageous
complement - a suitable completion, not a few kind words
condign - severe and deserved, not a human warren
deprecate - politely disapprove, not knock down for tax purposes
discrete - separate, distinct, not sneakily private
fortuitous - by chance, good or ill, not lucky-lucky
holistic - a sum being more than its parts, not all of it
manifold - in many ways, not a fast-trusting noise suppressor

guape - pretty,
like a senorita

androgyno -
of dubious,
perhaps
unimportant
gender



GUAPE ANDROGYNO

show up too with *dao*, a knife and *chao ona* their casual farewell. But we won't use their word for ship deck, *boong*, and we already have our own version of *xuc xich*, sausage (which is in any case French, from Latin for salt).

Borrowing will derive from machines, as well as people. Computerising our language has only just begun, and the next century will see that taken to new heights, or filed in a lower level language, to be precise. Low-level means harder to understand, more technical, and the users do love the secret ring of jargon. Already haunting the margins of our lexicon are *boot*, to start, *loop* to repeat, *default* for normal, *download* for transfer. This will increase. The live-ware, as the buffs joke about themselves, could start to speak in numerical language – *askeying* will be a good name, referring to ASCII, a computalk code. Schoolkids may count in binary terms, chanting 1, 10, 11, 100 to the skipping rope, not our threadbare dextile 1,2,3,4.

Tomorrow's folk won't forget things, they'll have file overload; schools will speak Logo, so it's not "Stop" but *Penup*, and to hurry the class along, the teacher cries *Fasturtle*. Much of modern language already presents as non-verbal. ASCII, COBOL and BASIC are all acronyms, initial-based words, more or less cutely worked out. These will flourish as they do now, from AIDS to NESBs (Non-English-Speaking Backgrounds), and bodies will sometimes plan them carefully, like the varied forms of CARE itself – Committee Against Ruining the Ecology is one of its meanings. Acronymic impact can be quite acrimonious: CREEP was not the best for the Committee to Re-Elect the President, especially when it was Nixon, and who could take seriously Mr Dawkins as Minister for DEET: it sounds like a child's horn crossed with a nasty chemical.

A more verbally seductive practice is the creation of blends, or portmanteau words (Lewis Carroll invented that title – they're like portmanteaus because they have two words in them). Motel and brunch are old ones for motor-hotel and breakfast-lunch – the US strikes again. From Telecom to Interpol the world labours with these word-games, big brothers of dinkier diminutives like *fax* or *pix*. *Forex* for foreign exchange bears an intoxicating sound, while *modem* sounds a modester device (cut down from modulator-demodulator), your computer's own *fonelink internet*.

We'll see many more of these expressions of compressed dehumanity, with time for only half of every word. They will swell any new dictionary and create its own bare name, *Nudictionary*. Some already sighted blends will, one hopes, fail for being so awful, like *skeggins* for a skirt-cum-leggings or worse yet, *cremains*, the residue of cremation. It's a Postmodernist kind of concept – and appropriately appears *Pomo*, a blend abbreviation for that very phenomenon.

Prediction in language, as in science, is risky. Anthony Burgess, a professional linguist before taking up fiction, suggested in *A Clockwork Orange* that Russian would massively infiltrate English in the future. His hero Alex and his *droogs* (mates) would *tolchock* (bash) a *chellovek* (fellow) for a good *smeck* (laugh). About 200 Russian words were repeated through the book, with their own glossary at the end. In 1962, the year of the missile crisis, Russian verbal power seemed mighty, but now has whimpered away, lending us no more than its own terms of surrender, *perestroika* and *glasnost*.

In one far-reaching sense, dramatic new vocabulary is a special feature; it's within a language

parasezo -
lazily stylish,
con sombrero

enemigos -
enemies to the
new Hispanic
world order

insulse - unsalted,
tasteless, stupid,
but very healthy
for you



DISEMPOWERED TSUNAMI

that most of its changes occur. Pronunciation, for example, steadily alters, partly through influence, partly through social attitudes. It is very hard to find schoolgirls who admit to speaking truly Broad Australian; but as a reflex of that, most actors today speak a recognisable Australian rather than the strangled Pommy tones that even Dad and Dave employed in old films. There is no real sign that local accents will decline, though more people will have two tongues, a folksy home-style and international-bland.

Oral smoothing will affect whole words. We no longer say the "i" in parliament or the "n" in autumn (though a few *chelloveks* still ring the ABC to *tolchock* them over the passing of these superfluous letters). The process of streamlining is accelerating now, as we increasingly say many words that once were only read. Orality is dynamic through telephone, tapes and – the coming crucial stage – voice-activated word-processors.

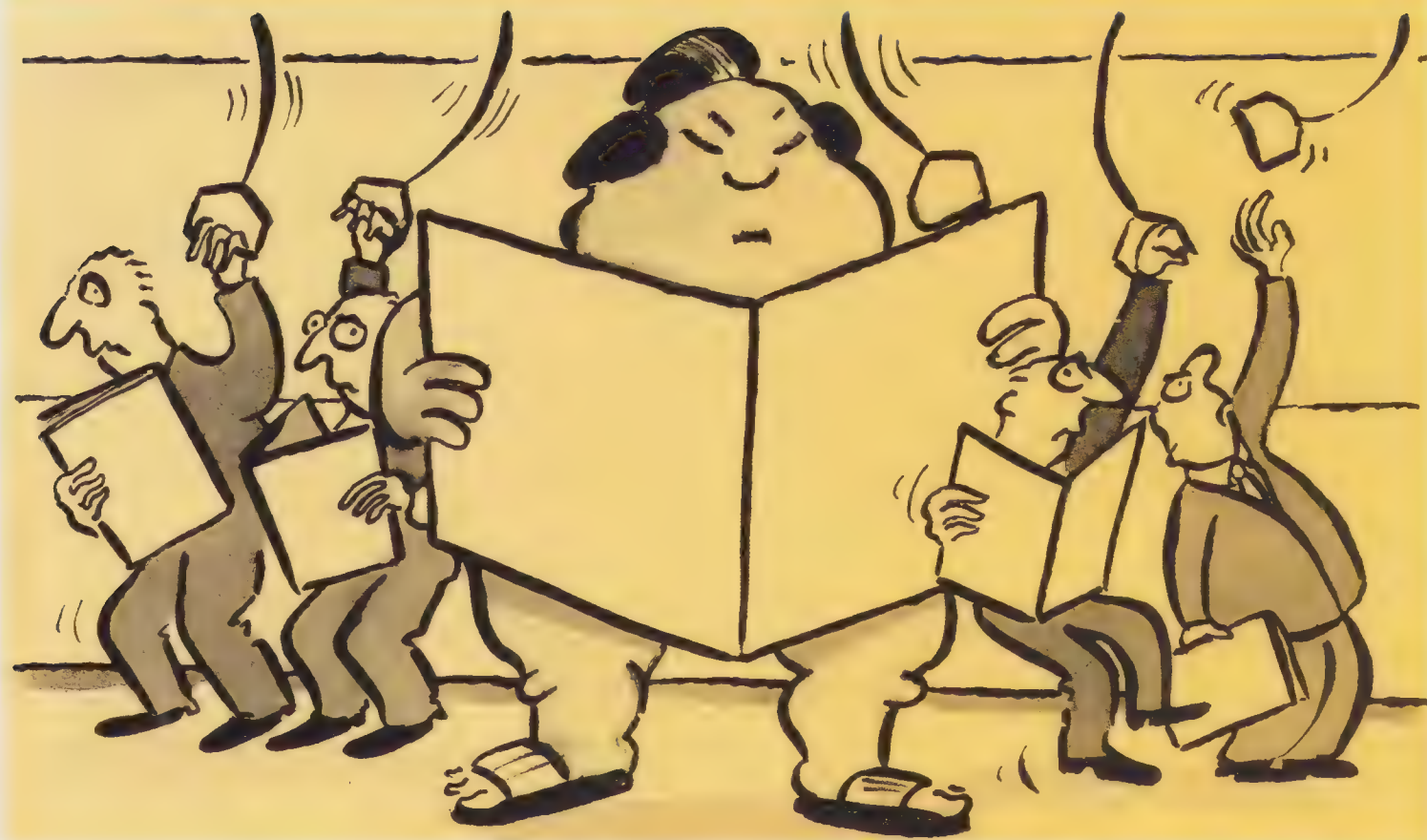
Repeated syllables are vanishing. *Adaption* is now common, not adaptation, so are *authoritive* and *preventive*, both short of a central syllable. Next no doubt will come *orientation* and *confrontion* – and not far away are *recitive* for recitative and *catonic*, not catatonic. Look out on the ABC switchboard.

But whole words and their sense will be lost, when they're confused with each other. In the US *alternative* has swallowed its sound-alike: you have to say *every other* if you mean the lost word *alternate*. Next to go, predictably, is *complement*, so completely merged with *compliment*, meaning praise, that the vanishing sense, "to go well with", may just have to be spelt out. *Fortuitous* is more or less finished, absorbed into *fortunate*; most people think they both mean lucky, but *fortuitous* referred only to chance events – which could also be bad. *Deprecate* and *depreciate* are thoroughly intertwined and each should soon sink the other. But *holistic* and *whole* have managed to make another word, *wholistic*, which means the same as total, so the next century loses *holistic's* fine sense of "more than the parts". There are more of these Losswords than many recognise; *condign*, "severe but just" has been crushed by *condominium*; *discrete* meaning "separate" is hustled aside by the quasi-politeness of *discreet*. *Manifold* has been muffled by a car-part; *beneficent*, "good-doing" by the pleasing profits of *beneficial*.

But words come in as others depart. Americans excel at linguistic revolving doors, bringing forward usages that no-one has noticed much. *Concern* and *virus*, once quite specialised, are heard everywhere, and technical terms like *ecoloical* and *electronic* live down in the street. *Theratest* is a burgeoning blend of this kind, and perhaps we'll soon have *biodeath* as life and logic fade away together. This process cannot be stopped, though it blurs the sharper side of language. To speak impressively, we keep handling the smart linguistic merchandise till it grows smooth and greasy, and change moves on.

Some predictions for future-exposure are *avatar* (parallel form); *atavistic* (going back a long way); *deponent* (passive in form but active in meaning – one for the feminists there); *insulse* (tasteless – a Burgess word); *ductile* (manageable, fine for child therapy or feel-good books); *recondite* (out of the way; a trend word for the unrecondite); *rubricate* (write in red or print as instructions – put this on your film-scripts); *serendipity* (finding the correct answer by chance);

Shimbun - newspaper, such as the Sydney Morning Herald or Shōwa (Jap.)



androgynous (doublegendered – like the former, this is half-pop already, but has further to spread, probably as *androgyno*); *hypnagogic* (great sound and means sleep-inducing, Tom Wolfe may be the first with this one); *vortex* (power centre; looks like a blend so must have drive); *pathologising* (with a *True Crime* ring, this brings together pain emotion and the physical, a wow movie word); *syndrome* (more popularist mileage in this still); *inhibitor* (semi-scientific for a control substance or person); *interoceptive* (internally stimulated, you on your onan). Some at longer odds are: *cachectic* (chronically debilitated, a personal favourite); *orectic* (pertaining to desire, and sounds like it); *presbyopia* (lengthening sight in old age, we all have that); *tombac* (Malay for cheap alloy, another quasi-blend and Third World too); *levin* (old word for lightning, deserves a flashback). Shy specialists heading for bright lights, these are our Upwords.

Language change from within seems to upset people most when a word changes its grammatical role. *To action*, for example, appears pointless when you could easily say “to act”. It has a banal briskness that appeals to some and will spread plague-like – and there’s the term for telling someone they haven’t got the job, *to unsuccess*. These blights on the dignity of language won’t fade or enfeeble. They can sometimes have point, like *to factor in* something from the noun “factor” or the Australian to have a *blue*, when you colour the air with violent sound.

But usually they’re crass and will develop in that mode. Journalists of the future may report nations will *treaty* each other, a Premier will *prize* an author for a fine book. Such back-formations can become even more awkward, and some *dorks* are already saying *amnese* for “completely forget”; all this amnesing could lead to my *insomning* quite soon. But we dare not laugh: the verb *to ombudse* has already been collected, presumably with gloves on.

The 21st century will not go verbally short of follies, because they are part of the sheer vitality of language, which is like life, for good and ill. Nowhere more sick-making (or *vomitoferous*) than in euphemisms, which will always gather in their timid clownish forms. If a lecturer dies in office (some of this might have that effect), then the faculty has an *unplanned vacancy*. Things will get worse, or should I say *disameliorate*? We are learning to call the disabled *the challenged*. No doubt soon the old, or elderly, or senior, will become *the advanced*, or perhaps the *non-immature*. On into the realms of Orwell and Wells. Unable (*disempowered*) to mention gender in words, will we distinguish between our major physical types (to put it politely) as those equipped to give birth *Parturocapables*, and those able to start off the process *Paterocapables*?

Even if boys and girls become *Parts* and *Pats*, they will at least be speaking English, as will increasing fractions of the world, those that are not Hispanic. We who will be deep in age, and grateful for it, might not understand much they say, but it will remain the same language, changing constantly for them, in ways not only unacceptable to their predecessors but quite unpredictable – and yet, if you follow language back and forth across time, never quite inexplicable. So, friends, let us hope; or, for the next century, *esperemos mi amigos*.

Stephen Knight is Professor of English at the University of Melbourne.

THE NEW MACQUARIE DICTIONARY

The world's best dictionary happens to be Australian.

It's only recently that hi-tech and dictionaries have got together, and the Macquarie Dictionary has taken advantage of its early involvement in this area with the production of its latest edition.

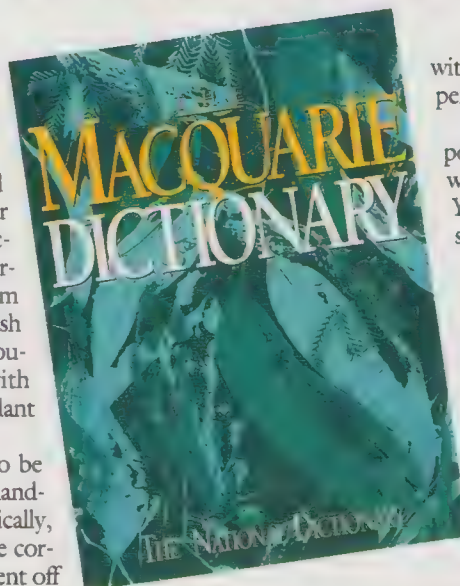
Dictionary-making before computers involved years of tedious and time-consuming manual labour. Dr Samuel Johnson, who wrote one of the first English dictionaries, defined lexicographer as "a writer of dictionaries, a harmless drudge", and he was clearly speaking from experience. Finding all the words used in written English can be a mind-numbing process of reading through thousands of books, newspapers and articles, always with the danger that something will slip past the most vigilant pair of eyes.

Once all the words have been found they have to be recorded, and this meant hundreds of thousands of hand-written cards, all of which had to be sorted alphabetically, and eventually, after much editorial agonising as to the correct meaning and history of the words, the whole lot sent off to a printer to be set by hand.

Computer technology has allowed all of this to happen automatically (well, almost), freeing the dictionary maker to think about issues rather than details.

The process involves scanning in large volumes of text, and pulling in large chunks of on-line data from newspapers etc. The state of the art in OCR or optical character recognition software has meant that it is relatively inexpensive to scan millions of words from printed texts, especially books. The fact that many newspapers are now printed from electronic text enables a direct on-line tap to this data, adding further millions of words to the lexicographical pot.

All this goes into a database called a corpus, which is basically a large body of text intended as a representative sample of written English. Once in there it is quite a simple programming task to find all the different words used, or all the words you don't already have in your dictionary. On top of this, you can get some interesting statistical information, like which words go



with which, and, at the cutting edge (and by no means perfected) an automatic grammatical analysis of the text.

The beauty of all this from the dictionary-maker's point of view is that the computer never misses a new word, reads incredibly quickly, and never gets bored. You can be confident that the basis of the dictionary is solidly set in concrete data.

The Macquarie Dictionary has been at the forefront of the use of this sort of databasing of Australian English. The corpus that has been collected currently contains over 14 million words, making it by far the largest such database in Australia. The corpus has helped in the gathering of thousands of new words which have entered our language over the past decade, and it has helped ensure that the new edition of the Dictionary, coming out at the end of 1991, is absolutely up to the minute as a record of our language.

Of course, luckily for lexicographers, computers still need a hand from humans in the making of dictionaries, so there are still a few people out there at Macquarie Dictionary. Computers are not very good at finding new meanings, as opposed to new words – they don't understand what they're reading. So if a word like interface is already in your dictionary in its strictest computer sense, a scanner won't tell you that something strange and interesting is happening when people start using it in the sense of ordinary human communication – "I'll interface with the boss on that." A computer program would check that interface was in its dictionary, give it the OK and pass on to the next word. It still takes a human reader to notice subtle changes in meaning.

The last example, though, points to yet another advantage to the lexicographer of computers – their amazing capacity to generate new words. Very few areas of our society have produced so many terms in such a short space of time, all requiring de-jargonised explanations for a bewildered general public. The dictionary-makers have plenty of work ahead of them trying to make the experience of this language feel less like an interface with a cold boot.

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Using the world's most sophisticated English language data base, the research team at Macquarie has detected no fewer than 10,000 new words or

derivations and meanings of words in the last decade. Who had heard of *bioethics* ten years ago? Or used a *fax*? *Yuppies* didn't exist. And even the most fiendish Scrabble player would have been hard pressed to tell you the meaning of *Zydeco*.

The fact is, we've modified the language as we've spoke it. We've imported new words from overseas. And the changes have been nothing short of amazing.

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MANAGING AUSTRALIAS

Australia's future lies in Asia. But new approaches and attitudes are essential if the old prejudices and fears are to be forgotten and replaced by a mature interdependency.

FUTURE

BY GARETH EVANS

There is a degree of uncertainty as to whether, or to what extent, we are an "Asian" country. Australia being an "Asia Pacific" nation is easier to manage, conceptually and psychologically, than us being an "Asian" one. But the substance of the issue cannot be skirted. We should acknowledge that we do encounter risks of misunderstanding and non-acceptance in our relations with Asian countries. The management of those risks in a constructive and productive way – the management, in fact, of Australia's Asian future – is a central task of Australian foreign policy.

Australia has fought against the reality of its own geography. We thought of ourselves, and were thought of by just about everyone else, as an Anglo-outpost. In Asian perceptions, we still carry some baggage from that past.

In approaching the management of our Asian future we should not over-estimate the difficulty of the task. The diversity of the Asian region is part of its challenge. In the sweep of countries from Japan to Afghanistan there was, before the Europeans, no word for "Asia", and no "Asian" consciousness – perhaps not surprisingly given the presence of six or more important and distinct cultural traditions, dozens of significant cultures of lesser influence, and a multitude of living languages.

That diversity means that, while Australians are manifestly not an Asian people, we are culturally and demographically equidistant from all its elements. Moreover, as the region itself becomes more economically focused – or, to pick up former Thai Prime Minister Chatichai's phrase, as the battlefields of yesterday turn into the marketplaces of today and tomorrow – questions of cultural and social identity become less dominant. As the region itself changes, Australia's distinctiveness is less striking. We no longer need be the odd man out in Asia – even if we are destined to remain the oddest man in.

THE POLITICAL DIMENSION

The pace of political change in Asia over the last two years has been on any view remarkable. Internally, democratic principles have been reasserted in Bangladesh and Nepal, taken new root in Mongolia, made significant strides forward in South Korea and Taiwan and Hong Kong and have been consolidated in India. The thwarted hopes of change in Burma, the military coup in Thailand, and



ASIAN

the continuing political repression of the now anachronistic communist regimes in China, North Korea and Vietnam remain the only real negative elements in what has been a generally very positive environment.

Internationally, the Soviet Union and the Russian Republic has buried the hatchet with South Korea and begun to do the same with Japan; South and North Korea are proceeding cautiously with political dialogue and have both joined the United Nations; China has mended fences with Indonesia, and – even more dramatically and significantly – with Vietnam; and all the political dynamics of the region have at last come together to make possible the resolution of the tragically long-running conflict in Cambodia, with the comprehensive settlement agreement signed in Paris on October 23.

Nonetheless, tensions and trouble spots, actual and potential, do still abound – including between Indian and Pakistan over Kashmir, within Sri Lanka, on the Korean Peninsula, and in the South China Sea (with six nations of competing territorial claims over various parts of the Spratly and Paracel Islands).

To the extent that there is any clear pattern in the shape of security developments in the region, it has three elements. First, there will undoubtedly be some continuing diminution in the presence and level of activity of the two nuclear superpowers. Policy-makers in the region will have to make judgments on the basis that the US may not be the all-pervasive stabilising influence in the region it has been for so long.

Second, there will be a greater capacity for influence by the region's other major powers – Japan, China and (subject to the way in which it masters its current economic troubles) India. And third the dramatic economic growth that has been experienced by a number of other countries in Asia has enabled them to devote substantial resources to

the modernisation and upgrading of their own defence forces: they are likely to seek, and will be in a better position to exercise, a degree of influence in political and strategic matters commensurate with the rapid pace of their economic development.

It is now accepted that what I and others have been talking about is not some dramatic overturning of existing security arrangements in the region but rather the supplementation of those relationships with additional layers and strands of co-operation and ultimately mutual dependence.

What is most fascinating in all of this is that suggestions that were not much more than a year ago perceived as radical, and even in some quarters as having the potential to undermine security to the extent that they cut across familiar bipolar ways of thinking, are now regarded as commonplace.

THE ECONOMIC DIMENSION

One cannot overstate the economic dynamism of the Asian region, and the challenge and opportunity this presents for Australia. The

major economies were recording an average annual GDP growth of about 7 per cent, and an export growth of 14.5 per cent. In less than three decades, production in North-East Asia alone had expanded from something less than one-quarter of that of North America's to one-quarter of that of the world. These achievements reflected several factors: relative political stability, hard-working and increasingly well-educated work forces, high rates of savings and investment, sound economic management, and a crucial willingness to undertake rapid structural change.

The successful economies have also displayed great skill in taking advantage of the relatively open post-war international economic order – and the huge demand generated by US consumerism in the 1970s and early 1980s – by pursuing export-oriented industrial strategies. The result has been a region whose trading instincts are outward-looking. The economies of the region have also become increasingly linked; the pattern of regional trade and investment, the direction of technology flows, and inter-linkages in sectors such as tourism, have all combined to produce a regional economic map crisscrossed with ties of interdependence.

The task for Australia is to lock itself into this regional economic dynamism to the maximum degree possible. There are certainly major

with the plan, now in place, to have primary and secondary school students routinely taught at least one of six Asian languages.

For all these positives, problems continue to arise from time to time. Not the least of such problems in recent years have been those generated by material appearing in the Australian media critical or denigratory of aspects of Asian society, sometimes deliberately so, sometimes quite unintentionally. When expressions of this kind lead to strongly adverse reactions by Asian governments, as has been the case on occasion, a very tricky situation is created for Australian governments. Our own cultural tradition of media freedom inclines us to offer no reaction at all other than to point to that tradition. However, that response may be quite inadequate to protect other Australian national interests involved.

Finally, there is the question of the extent to which, if at all, we should as an Australian government feel inhibited about advancing certain value-based policies – in particular those promoting democracy and other human rights – in our dealings with Asia, given that there will always be plenty of voices to be heard saying that we should mind our own business.

My own clear view is that Australian engagement with Asia does not imply sacrifice or subordination of our distinctively Australian national characteristics. It may well make

One cannot overstate the economic dynamism of the Asian region, and the opportunity this presents for Australia.

opportunities emerging in Vietnam, with its 65 million population and rapidly developing economic (if not yet political) liberalisation policies. Indonesia – on our immediate doorstep, with 180 million people – is an even more obvious market for Australian business to be getting excited about.

It will only be on the basis of our competitive efficiency that we will be able to expand our exports of simply and elaborately transformed manufactures and services, and to generate foreign investment here in higher technology industries. It was not charity or altruism that prompted Japan and then Korea to buy our raw materials on the scale they have; it was our efficiency as a producer. Australia is a world leader in low density, long distance digital communications systems. We have highly developed skills in biotechnology, agri-industries, agricultural and medical research, mining technology, minerals processing and a whole range of niche product areas. Many of these skills and technologies are ideally suited to markets in the Asia Pacific region.

THE CULTURAL DIMENSION

If Australia is to engage more comprehensively with Asia in the years ahead then perhaps the greatest need of all is for Asians and Australians to get closer, as Ross Garnaut elegantly put it, "in each other's minds". Australia has, to put it objectively, a more open and tolerant society than any in Asia. That is clearly reflected in immigration policy, where the White Australia policy has been dead for more than two decades; where between a third and a half of our annual migrant intake (amounting to 40,000-50,000 people each year) has since the late 1970s been Asian; and where our per capita absorption of Indo-Chinese refugees, in particular, has been higher than that of any other country in the world. There are presently well over 600,000 people of Asian descent living in Australia; this represents about 3.5 per cent of the population now, but the figure is expected to rise to 7 per cent by the year 2010.

Furthermore, while older generations of Australians were less knowledgeable about Asia and Asians than they might have been, and some wartime prejudices have been slow to evaporate, a major effort is being made to systematically educate current and future generations of young Australians about the region in which they live – not least

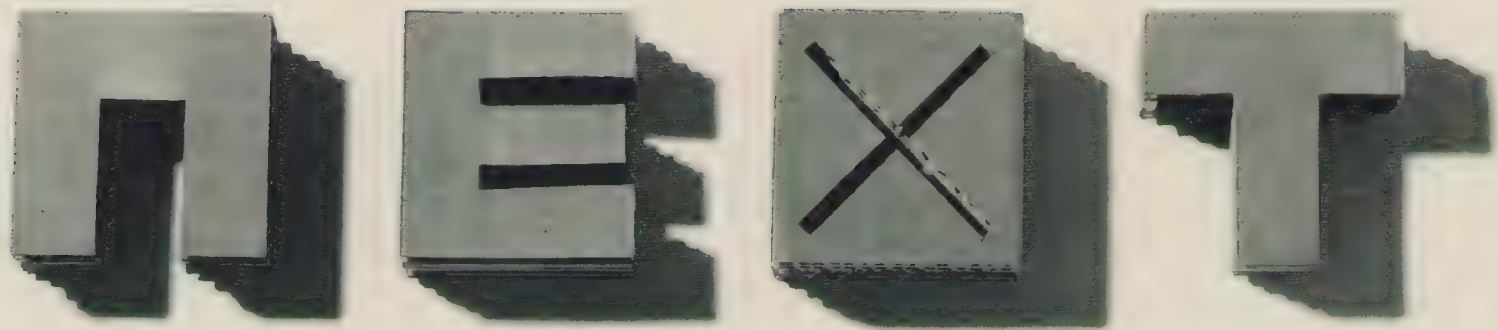
sense in Asia to moderate some of the directness that we might routinely deploy in encounters within Australia, or with North Americans or Europeans. But that is simply a matter of learning the business of normal neighbourhood civility. It does not mean moderating our commitment to values which are at the core of our sense of national identity and worth – in particular, those of democracy and individual liberty.

Like many developing countries, they have tended to argue that an escape from poverty through economic development is a necessary prerequisite for the application of those political and civil rights which so preoccupy democratic developed countries. They point to the economic and social causes of human rights violations, such as international indebtedness, deteriorating terms of trade, threats to the environment and the like.

The great democratic experiment in India, one of the world's poorest and most densely populated countries, continues to work and a whole series of Asian countries have in recent years strengthened their democracies against the odds. Despite recent setbacks the urge to go down this path remains palpable in China. Human dignity is inalienable, and the same human rights exist in every kind of society. The urge to democracy is no more than a reflection of these realities. Again, in pressing its neighbours for recognition of basic human rights, Australia is not raising doubts about their integrity as sovereign states. Of course we recognise the claims of sovereignty, but we ask that the universal rights of human beings be also acknowledged and respected.

Australia will not lose its identity by becoming ever more involved in Asia Pacific regional affairs. On the contrary, that identity will go on developing, losing attitudes of exclusiveness and superiority which may have been part of it in the past, and gaining in the process a new flexibility, a new capacity to learn and adapt, and a new maturity.

Gareth Evans is Australia's Foreign Minister. This article is adapted from the Third Asia lecture at the Asia-Australia Institute, University of NSW, Sydney, on October 3, 1991.



21 • C's SECTION OF
NEWS AND TRENDS

'Dancing dinosaurs' debunked

BY PETER POCKLEY

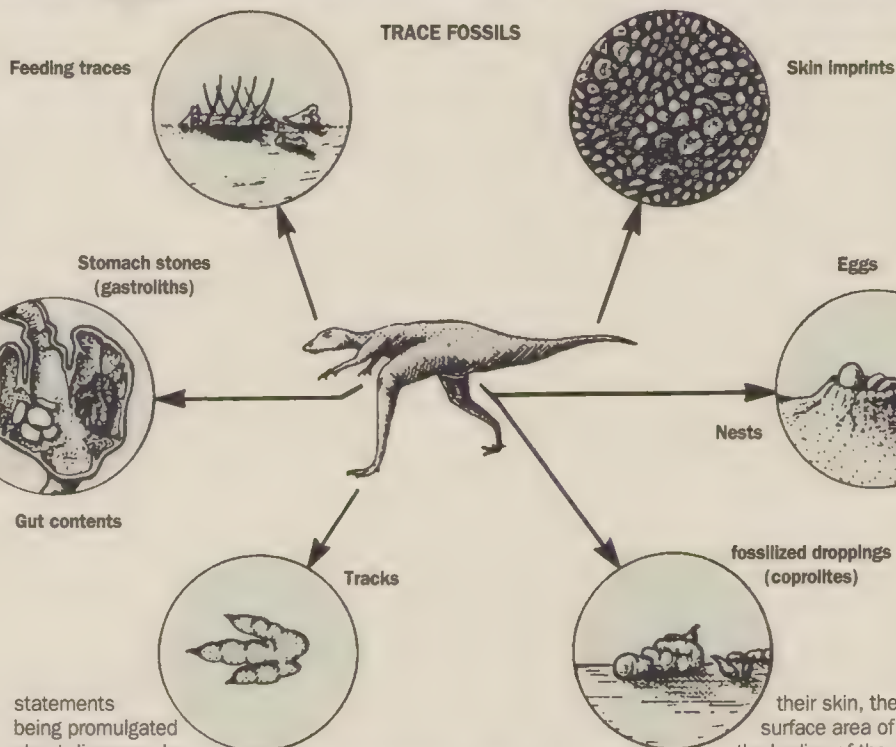
Dinosaurs have become such powerful symbols of dominance followed by total extinction that extravagant claims about them make for easy headlines. One has been the "dancing dinosaurs" theory popularised by the American, Dr Robert Bakker, who holds that some of the now-extinct beasts could run so fast that all their feet left the ground at once.

This is one of the theories being attacked by a Brisbane zoologist, Dr Tony Thulborn, who wants to tone down the dinosaurs' image, based on a careful assessment of the evidence.

He contends that "much of the best-selling literature on dinosaurs is horrendously inaccurate, poor quality science." During 1991, Thulborn published his criticisms and carried them to conferences in England.

Thulborn, a reader in zoology at the University of Queensland, was the only Australian scientist giving a paper at the British Association for the Advancement of Science (BAAS) meeting in Plymouth. The meeting marked the 150th anniversary of the BAAS conference in the same city where Professor Richard Owen coined the term *Dinosauria* (for "fearfully great reptiles.")

Thulborn branded as "blatant untruths" some



statements being promulgated about dinosaurs by people whom he described as "skilled weavers of fairy tales." His strong views were supported by Mr Robin Reid of Queen's University, Belfast.

He later presented his conclusions to another major conference – the symposium on vertebrate palaeontology and comparative anatomy – at Oxford. On his return he said he was very pleased with the reception given to his ideas.

One example concerns the debate raging about whether

dinosaurs were "warm-blooded", like today's mammals, or "cold-blooded", like the reptiles. The largest mammal on Earth today is the elephant, weighing up to seven tonnes. These are small compared with some dinosaurs which weighed 50 tonnes, others 80 or even 100 tonnes.

While cold-blooded reptiles can survive at high temperatures which would kill mammals and cool off by radiating excess heat through

large dinosaurs was insufficient to keep them cool.

Thulborn and Reid say burning of the food dinosaurs needed for survival would have cooked them alive if they had been cold-blooded. When small, they regulated their temperatures internally just like the mammals which succeeded them as the most successful family of animals to inhabit the Earth.

As they got larger, the dinosaurs changed their

temperature control to something between the warm and cold-blooded systems, according to Thulborn. This means that, although their sizes were phenomenal by today's standards, dinosaurs were not remarkable physiologically.

Driven by the paucity of funds (he had to pay his own way to the conferences in Britain and receives only \$100 as a general grant for his research) Thulborn has focussed on understanding the ephemeral traces of dinosaurs – their footprints, nests, eggs, droppings – rather than the expensive pursuit of finding hard fossil remains of bones.

His Plymouth and Oxford presentations and a refereed paper for *The Beagle*, the journal of the Northern Territory Museum, point out that the running speeds of the fastest dinosaurs, calculated from the footprints preserved in rocks, are not remarkably great.

Bakker, one of the best-known authors on dinosaurs, has claimed some dinosaurs could travel at up to 100 kmh. He has promoted the view that large dinosaurs were able to leap off the ground (dancing dinosaurs) and this provided backing for the theory that they were warm-blooded.

Thulborn disputes these sums, saying 58 kmh is the fastest that can be deduced from the evidence (for

CONTINUED PAGE 20



AUSTRALIAN NEWS

Australia's cars and trucks will be sprouting disk-shaped antennas in the next couple of years if CSIRO chief executive Dr John Stocker has his way. The antennas, expected to cost \$4000 to \$6000, would enable drivers anywhere in Australia to stay in touch by phone or fax with the world, via satellite.

"I have a vision that in the not-too-distant future, these little Australian antennas might be as common as the

Garfield cats you now see stuck to car windows," Dr Stocker told a conference in Sydney. CSIRO's Division of Radiophysics had developed the prototype to access Aussat's Mobilesat system, and a business plan is being put together with two Australian communications companies, Mitec and Codan.

Cargo ships do not look like high-speed vehicles. But the Russians claim to

be working on a version which will travel at more than 300 kph. Already some craft can move at 70 knots, or approximately 130 kph. It took ships in the First Fleet eight months to make the journey from England to Australia: today it can be done in less than a fortnight. Professor Lawry Doctors, of the naval architecture section at the University of NSW, told a conference in November: "It

probably would come as a surprise to most people that around 95 per cent of all cargo in and out of Australia is by sea. Safety is becoming an important corollary of increasing speeds."

New generation biosensors are being developed to detect pollutants in food or waste. What's more, the artificial sniffers have better senses of smell than some animals.

According to the CSIRO, which has brought together 20 scientists from different backgrounds to develop the technology, the sniffers could detect pollutants at just a few parts per billion. The substance to be tested is passed through an extremely sensitive ultrasonic detector. The detector's surface, impregnated with sensitive antibodies, can detect small amounts of specific chemicals.

Gallinimus, an ostrich-like dinosaur). He maintains speed is related to body size and not body temperature.

He quotes calculations by American physiologist, Dr Ted Garland, that the optimum size of an animal for movement along the ground is 119 kg – like reindeer or caribous which have also evolved limbs favourable to fast running and without carrying too much weight and can achieve a “flying” stride.

As animals get heavier they have to use extra energy to support their weight and they become correspondingly slower. This applies equally to the elephants of today and the large dinosaurs of yesteryear, Thulborn says.

The size and rate of growth of dinosaurs has a profound effect on their physiology and, as it is very difficult to disentangle these factors, he prefers caution rather than over-confident conclusions promulgated as certain facts.

Crappy theories

Another of the “myths” attacked by Thulborn concerns the dung remains of dinosaurs, or coprolites, which provide useful clues to the identity, behaviour, habits and diet of the animals. Some

scientists have claimed to have discovered droppings up to 200 cm long. But Thulborn says these are more likely to be burrows of invertebrates which have been filled with sediment.

“The largest single coprolite reasonably attributed to a dinosaur is about 30 cm long,” Thulborn wrote in a paper last year. Most genuine dinosaur droppings found as fossil remains are only about four cm and eight cm, with some as small as one cm, he concludes.

Egg tales

Yet one more of the “myths”, according to Thulborn, derives from the discovery in France, Mongolia and Montana of fossilised dinosaur eggs.

These have provided scientists with a rich source of information about dinosaurs, because the skeletons of unborn embryos could be studied along with the habits and habitats of the adults.

This is another area where Thulborn is critical of “the errors liberally strewn in popular publications”, such as the conclusions drawn from the nests of eggs discovered in Mongolia by American expeditions in 1922 and 1923.

These were so confidently

attributed to the primitive-looking, horned *Protoceratops* that these dinosaurs have been reconstructed in the in the American Museum of Natural History in New York with a life-size display of their skeletons standing around a crater-shaped nest containing their eggs.

The nest, supposedly of *Protoceratops*, has been regarded for the past 50 years as the “typical” or “standard” textbook example of a dinosaur nest. From its complex layering of eggs an intricate behaviour by this particular dinosaur had been assumed. Thulborn says the attribution of this type of nest to *Protoceratops* had exerted a profound influence on our understanding of the reproductive biology of dinosaurs – but was false.

Contrary to the long-standing view, he said, the crater-shaped nests are more likely to have been the product of an ornithomimid dinosaur like the familiar *Iguanodon*.

Thulborn’s views will fuel the seemingly unquenchable thirst for information about dinosaurs among scientists and the public alike. This thirst is now being assuaged by 800 books about dinosaurs being in print in English alone.

What wiped them out?

The field of most popular speculation and an area of great contention among scientists is the cause or causes of the sudden extinction of dinosaurs.

Dr Alan Charig of the Natural History Museum of London has put the various theories in perspective by listing no less than 95 possibilities for what happened at the boundary between Cretaceous and Tertiary periods 65 million years ago when dinosaurs disappeared.

He is chary about plumping for any one or for rejecting others, even though there are quite fanciful suggestions which always raise a laugh. He classifies the theories in various ways, such as:

General catastrophies, like a collision with an asteroid or a supernova explosion near the solar system.

Maritime catastrophies, affecting only organisms living in the sea, such as sudden increases or decreases in the salinity of the sea.

Terrestrial catastrophies, affecting only organisms living on the land and not those in the sea, such as sudden increases or decreases in rainfall and humidity.

The extinction theories generating the most publicity

have been events which would have changed the external environment, either suddenly or gradually. Dr Charig listed several effects from outer space:

- The Earth passed through a dust cloud, obscuring the Sun and cooling the Earth.
 - Meteorites, asteroids or comets collided with the Earth, also causing climatic change.
 - Sunspots and solar flares caused increases in radiation reaching the Earth’s surface.
 - Nearby stars exploded as supernovas, showering the Earth with high-energy particles.
 - Beams of electrons and positrons (electrons with negative charges) emitted by rotating black holes (the result of the gravitational collapse of a galaxy).
- Charig has a large list of theories involving changes induced on the Earth itself. These include:
- Reversals of the Earth’s magnetic field.
 - Outpourings of volcanic dust and ash.
 - Increases and decreases in temperature.
 - Increases and decreases in rainfall and humidity.

Theories relating to the food supply range from too much food to too little. Lack

of food theories include:

- Changes in vegetation consequent on the overproduction of excrement by dinosaurs.
 - Caterpillars devouring vegetation before birds evolved and learned to eat them.
- Charig also lists a batch of ecological theories, such as:
- Overkill by predators (meat-eating dinosaurs exterminated the plant-eating ones and then starved to death themselves).
 - Fights between dinosaurs.
 - Overcrowding.
 - Drowning in their own excrement.

One theory has received a boost from a paper published recently in the international journal, *Nature*. Two Canadians, Dr David Carlissie and Dr Dennis Braman, reported the discovery of a multitude of minute diamonds in sedimentary rocks laid down at the boundary between the Cretaceous and Tertiary.

Diamonds can only be formed when carbon is subjected to high temperatures and pressures. The theory is that the ensuing disruption of the Earth’s climate would have been fatal to the previously successful population of dinosaurs.

NEXT IN AMERICA



> The Sony Data Discman is about to do for information what the Walkman did for music. The idea is simple: a palm-size portable computer, using interchangeable discs, serves as encyclopaedia, dictionary, wine guide, accountancy directory, or any one of scores of other functions. Eventually it is likely to make paper dictionaries and similar reference works obsolete. Single-purpose palm-computers, which will not have the flexibility of the Sony device, are also under threat. A more advanced version being tested is the Bookman, which has a bigger screen, animation and audio capabilities. The Discman will sell for about \$US450, with discs costing \$30 to \$50.

NEW YORK TIMES

> A “moming-after” pill may one day be developed that can repair the sun’s damage to the skin. Bio-organic chemist John-Stephen Taylor of Washington University in St Louis has synthesised sunlight-damaged DNA to study the processes that lead to cancer. His work could produce a more effective sunscreen or even a drug that reverses the damage. The depletion of the ozone layer means that more people will be susceptible to skin cancer. With a 50 per cent depletion of the ozone layer, says Taylor, it would take only 10 minutes to effect the same amount of DNA damage that would occur in an hour with no ozone depletion.

THE FUTURIST

> Cars that can call for help the moment they are stolen: that’s the system now being tested in Detroit, Chicago and Dallas. Subscribers buy a Teletrac “vehicle locator unit” about the size of a paperback, which can be hidden anywhere in the car. If the ignition is forced with a dummy key or the vehicle is hot-wired, monitoring computers can track its signal to its destination.

NEW YORK TIMES

> Shoes you might buy soon could be made out of rubbish. Walking shoes designed and distributed by Northwest Quality Innovations of Lake Oswego, Oregon, are made with scrap plastic from nappies, tyres and foam rubber, as well as sawdust, paper bags and coffee filters. The DejaShoe hit the US market last spring and may make it to stores throughout the country in the near future.

THE FUTURIST

> Lightweight materials now being used in power tools will allow more women to become “do-it-yourselfers,” predicts a

report by Frost & Sullivan, a market research firm based in London and New York. Most electric portable power tools are purchased for use in the home, and most buyers are men. Manufacturers hope that the lighter, more efficient drills, saws, grinders, and other tools will widen their appeal to handywomen.

THE FUTURIST

Food in the year 2000

- Twenty per cent of households will have two microwaves.
- The influence of children on what is eaten in the home will be double.
- Dining out will account for 40 per cent of the total people spend on food.
- Baby boomers reaching 50 will create a demand for food previous generations did not consume in such vast amounts: pizza, potato chips, cheese and chocolate among them.

These predictions have been made by Watts Wacker, a senior strategy consultant with market researchers Yankelovich Clancy Shulman.

THE CHRISTIAN SCIENCE MONITOR

> A new extension to the state capitol in Austin, Texas, will take four acres of land and be four stories tall but won’t change the landscape. The capitol extension is going underground. Now under construction, the extension was designed to be extremely energy efficient, easily passing the state’s strict new standards. Among the energy-saving features: direct digital control system for thermostats, high-efficiency fan motors and fluorescent lighting, double-glazed skylights, and occupant sensors for controlling ventilation. The underground design should save about \$86,000 a year in energy costs compared with an above-ground design. Construction should be completed in late 1992.

THE FUTURIST

> Peter Rentzepis, a chemistry professor and researcher at the University of California, has invented a laser-based device the size of a sugar cube that can store 6.5 trillion bits of information. That is 2000 times more data than top personal computers can currently store on their hard disks. While incorporation of the idea in a pc is some way off, Professor Rentzepis says the input and output is much faster and there are no moving parts.

NEW YORK TIMES



Age of the insect for robots

A graduate from Flinders University in SA now sets the pace in artificial intelligence. CHRISTOBEL BOTTEN reports from New York

Rodney Brooks takes delight in thinking up ways to turn his growing horde of robots (he calls them fast, cheap and out of control) upon our world. Any day now, he says. And you had better believe him, for Brooks is not one to suffer a lapse in imagination or tenacity in pursuing his vision to revolutionise artificial intelligence with insect-like robots.

He envisions tiny robotic critters scraping barnacles off ships, exploring Mars, assisting in delicate surgery, not to mention those designed to mow our lawns or help him keep track of his mail. All this, perhaps within his lifetime, he says.

The fact that his ideas challenge the traditional way in which robotics has been developed only inspires him. Brooks revels in the controversy, enjoys being dubbed the bad boy of robotics, is flattered to have made the cover of magazines such as *Discover*, *Science* and *Fortune* (which named him one of America's top 12 hot young scientists).

Listen to him. Why are your ideas called radical? "Because they are different," he says. Why do more traditional colleagues decry your ideas?

"Because some are threatened . . . there are individuals who are very angry. They are afraid of it. I guess I provoke them by saying they are all wrong."

The 36-year-old Australian-born Brooks, who built his first machine in Adelaide at the age of 12 (an unbeatable noughts and crosses machine he put together with old switchboard parts) now is an associate professor of computer science at the Massachusetts Institute of Technology in the US. This is where he does his dreaming, within MIT's artificial intelligence (AI) laboratory, as the leader-cum-founder of the mobile robot group (or insect lab), churning out the likes of Ghengis, Shakey, Herbert and Attila.

What makes Ghengis and company radical is that they are created in the image of insects, as opposed to the conventional generation of robots modelled on the human image. Brooks's premise is not to try to build insects, but to build robots that incorporate "the ability of insects to do a lot in the world without much neural circuitry".

Brooks regards the conventional approach to robot control, derived from the standard AI model of human cognition, as cumbersome, costly and not terribly efficient. "The existing mobile robots would just sit there, computing for hours on end before they would make a move," he told the *Research News* science journal. According to the journal, a robot made to that

model first has to process the data its sensors pick up from the environment so it can identify objects in its field of view. Next it has to construct some kind of internal data structure to represent the scene as a whole; then reason about that structure to construct a plan for accomplishing its goals; then figure out how to execute those plans as a specific sequence of motor commands. Only after all that has been accomplished can the robot actually do anything.

Not one for slow-witted robots, Brooks's answer was to eliminate this computational "bottleneck" by eliminating cognition. Forget about asking robots to reason, or plan; rather, program them to carry out specific but coherent behaviours, such as "avoid obstacles", "back off", or "explore".

Brooks borrowed from insects the way in which they respond with simple reflexes to environmental stimuli. Insect bodies are dotted with widely-distributed sensors that work almost autonomously. Brooks and his colleagues imitated this "distributed intelligence", doing away with the need for a cognitive co-ordinating brain, but nonetheless allowing his robots to act cleverly, and quickly, in an arrangement of interacting perception-action

interacting perception-action links, or behaviour circuits. He calls this arrangement, or philosophy, "subsumption architecture", a term he coined as "a recapitulation of evolution in an informed sense, where we built up the intelligence of the robot by building layers".



Rodney Brooks: "My appetite is large and I have to feed it".

Ghengis embodies these ideas. The foot-long six-legged Ghengis, built in 1988 by graduate student Colin Angle, employs 57 behaviour circuits dedicated to local activities in the legs and whiskers. Ghengis can wander about the floor of the insect lab, spotting people with its infra-red eyes, detecting obstacles in its path with its whiskers and taking advantage of sensor-studded legs to help it "feel" its way over or around any obstacles. Those who have seen Ghengis at work describe it as eerily life-like. It has "stand up" behaviour, in which it pulls up on six legs, "walk" behaviour, in which its legs alternate in much the same gait as real insects, "leg lifting" behaviour and "force balancing" behaviour to stop it from toppling over when "moving forward". Ghengis's successor, Attila, even incorporates a miniature video camera (and 150 sensors, 23 motors and 10 microprocessors within a 3.6 pound body).

It is exciting stuff. But Brooks refuses, politely, to be sentimental about his robots. He calls them "things". At "some scarce level", he says, he regards them with affection. "But I would not get too carried away with that . . . compared with kids, it is one part in a thousand."

What really draws him are the enormous possibilities. "I guess I would be happy to build robots that really are deployed in the world and become accepted in the fabric of life, not things you get sentimental about. And it is possible. If you go back 20 years you would have thought

it dopest that you would have a computer in your toaster. The leap (to insect-like robots in everyday life) is of comparable size."

Such enthusiasm and belief in the insect-like robots ensures Brooks now spends a lot of time on the speaking circuit - and raising capital. "I do enjoy giving talks and getting that feedback. I teach and I do research, but I also spend huge amounts of time hustling for money. My appetite is large and I have to feed it."

Money may be hard to come by, but Brooks has no shortage of imagination ("that has never been my problem;

now I have so many ideas and plans I cannot possibly do them all in my lifetime"). Neither is there a lack of humour, whether shared with his 11 colleagues or directed, wickedly, at the more conventional robotics community. Yes, he admits he likes stirring things up. An address on "the illusion of cognition" earned him the title of "the lion going into the Christians' den". He adored the description; he keeps personal attacks on his maturity taped to his office door.

As far as things Australian go, Brooks says he feels somewhat torn but "in my current position it is hard to think of anything comparable (to the insect lab) in Australia. I would really have to change my attitude about what I wanted to achieve". When last here, in Sydney in September, he addressed an international AI meeting which honoured him as co-winner of the esteemed Computers and Thought prize.

For now he is keen to indulge in the passion and the fun he insists his graduate students must embrace if they want to continue working in his lab. He still has heaps to achieve. His goal: "Arnold Schwarzenegger would be good."

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Robots stay bottom of class

Building a better bug

Rodney Brooks's behaviour-based approach to robotics embraces a philosophy he describes as "subsumption architecture". Subsumption architecture, developed by Brooks in defiance of the traditional artificial intelligence approach, creates robots based on task-achieving behaviours rather than information-processing modules.

This architecture is used in robots which explore, build maps, have an on-board manipulator, walk, interact with people, navigate visually, and learn to co-ordinate many conflicting internal behaviours.

In this new approach, a robot embodies a number of behaviour-generating modules, each of which

connects sensing to action. The behavioural competence of the system is improved by adding more behaviour-specific networks to the existing network. This process is called layering; layers are added incrementally, and new layers may depend on the successful operation of earlier layers.

"This is a simplistic and crude analogy to evolutionary development," says Brooks. "As with evolution, at each stage of development the systems are tested. Each of the layers is a behaviour-producing piece of network in its own right, although it may implicitly rely on the presence of earlier pieces of network. For instance, an explore layer does not need

to explicitly avoid obstacles, as the designer knows that the existing avoid layer will take care of it."

The first demonstration of the subsumption architecture was on a robot called Allen, which used sonar readings to keep away from moving people and obstacles, while also avoiding stationary obstacles.

More sophisticated is the ant-like 35-centimetre-long Ghengis, which Brooks programmed to walk over rough terrain. Ghengis embodies 12 layers of behaviours which give it the ability to stand up, then to walk, then to adjust for rough terrain and obstacles, and more. Attila, the latest robot, is a more competent, faster and more robust version.

The Hitlers in hiding

I spent several years growing up in post-war Vienna. It was surprising for a newly arrived Brit kid to find so many Austrians willing to confess to having Nazi families. They seemed such ordinary little people; somehow I'd expected Nazis to be twice as big as everyone else, to be always shouting and kicking someone. Instead they were simply little Fritz's or Gertrude's parents. And they offered me cake.

"Hitler made some mistakes, of course, but he was right about a lot of things, you know." I never went back. Being English (we won the war!) and more than a little flash, I was leader of the gang for a while and conspired to throw little Fritz into the pond on his way home from school. Books and all. I never discovered what was so different about those who could be Nazis. Even those who, according to my parents, had done unspeakable things to others, seemed quite ordinary.

I was reminded of all this during the Gulf War. Even allowing for the adjustment of truth for propaganda purposes, there is no doubt that some Iraqis behaved hideously in Kuwait, murdering and torturing with a zeal beyond civilised comprehension. Then it was Kuwait's turn to take revenge. Why are so many capable of this hideous

behaviour? Is it when the situation requires? Or do you have to be some rare type of monster to be able to act out such evil?

There are those who believe that it's just the animal or cave dweller in us all: those millennia of hunting and fighting and being hunted in the millions of years of our hominid and even-modern human history must have left the instincts intact, ready to emerge. The great ethnologist Konrad Lorenz thought this. He often put it rather pungently.

I don't agree. Yes, we have characteristically human qualities, we do not behave like baboons or brolgas (except at Christmas parties). And it would be remarkable if we'd lost all those tendencies, acquired over thousands of years, in just the few hundred during which we, as a species, have lived in cities.

But we are also immensely flexible. We can mould the human mind to do almost anything, become anyone: Nazi or saint, torturer or healer, thug or pacifist. That is why each nation has managed, sadly, to have its turn as villain of the piece. The Americans murdered their



ROBYN WILLIAMS

Indians, the British their slaves, the Spanish their heretics, the Japanese their prisoners, the Germans their Jews and gypsies and Slavs, the Australians their Aborigines. Everyone's had a go.

But only when the circumstances allowed. The late professor Robyn

Winkler, who once taught psychology at the University of WA, did some research with Greek colleagues on the torturers operating during the time of the Colonels (in the '60s and '70s). They found that ordinary neighbourhood greengrocers and plumbers could be turned into heartless brutes, torturing even children with routine, even bored indifference.

If the regime is authoritarian, the training harsh, the penalties for disobedience severe and the rewards for compliance bountiful, then most of us will fall in with whatever nastiness is required.

A few resist. Their heroic stubbornness, to the end, is written through history. But the behaviour of the ordinary person is banal. So is the monster. That is why we must not be duped into believing that warlike

tendencies in human beings are inevitable and to be expected. They can equally be rare and surprising. Most of us spend most days being reasonably civilised, so why not?

This is important to understand if we are to plan effectively for the future. The pessimistic view of "Human Nature" is that we are basically flawed, will invariably go ape if given half a chance, and must be kept in check by strong police forces and armies. The contrary view is that we will be tolerant and peaceful if circumstances are right, and can let off plenty of steam in ritual encounters such as football matches and croquet.

Given the hideous, unpredictable and unforgiving nature of war, I can't imagine societies in the 21st century being prepared to risk another holocaust. Only a tiny minority of people is unreachable and violent beyond remedy, and they are usually nuts. The rest will respond, I'm sure, and so are many scientists, to rational persuasion and the reasonable provision of comfort. Equity is the answer. Not guns: butter.

On the first day of the bombing of Baghdad the Americans spent \$US650 million; the entire annual budget of the United Nations Commission for Refugees is \$530 million. I think the answer's obvious.

Robyn Williams is Chairman of the Commission for the Future

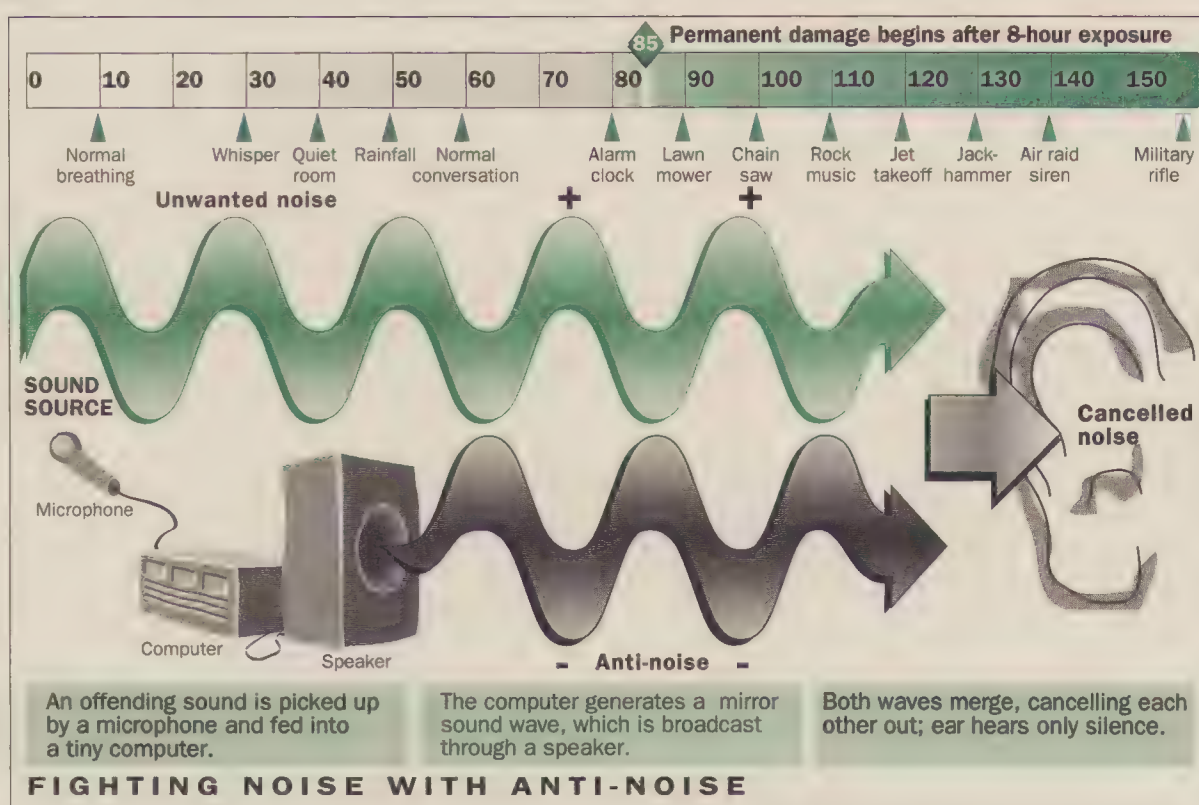
Waving goodbye to unwanted noise

The sound of silence suddenly has new meaning as scientists in the US fight noise with anti-noise. Mufflers and insulation have been traditional methods of reducing undesirable squeaks, squawks, drones and hums, but annoying sounds remain a constant nuisance in cities around the world.

Tests have shown that children can suffer serious skill loss in classrooms close to high noise levels, and workplace sounds raise blood pressure, cause headaches, make people aggressive and even threaten permanent hearing loss.

Sound comes in waves, and it is those waves that are being used to turn back the tide on noise. The waves that emerge from a loudspeaker mirror the original sound, but with peaks in place of the valleys and vice versa. When the two sounds merge, the waves cancel each other out in golden silence.

Simple, repetitive noises can be dealt with relatively easily. At least two US companies are working on doing away with car mufflers. The idea is simple: a microphone takes a sample of the car's sound, which is regenerated by a computer and played through speakers at the rear of the car. The microchip device, which could



be on cars in the US within two years, is more efficient than traditional mufflers and increases fuel efficiency by up to 25 per cent. Anti-noise headsets, being used to reduce cockpit noise in small planes, may also soon give drivers a sound-free interior

because engineers are testing anti-noise signals played through car stereo speakers.

Vibrations work in a similar way, and scientists believe anti-vibration wave patterns could prevent cracks and fatigue in expensive machines. In Sweden, Electrolux recently

hired the US company Noise Cancellation Techniques to produce household appliances hushed with anti-noise. Other companies are experimenting with everything from fans to submarines.

At this stage, it is not clear whether playing heavy metal

rock records backwards offers relief to the parents of high-decibel teenagers. But researchers make the serious point that unwanted noise should still be treated as air pollution and as such, reduced rather than countered. Hear hear.



WORKS IN PROGRESS

Eureka winners hit paydirt

A round-up of current Australian research, compiled by PETER POCKLEY

In only their second year, the Eureka awards, announced at the end of September, have established themselves as the most widely recognised awards for achievement by Australians in science.

The scheme was the brainchild of Robyn Williams who is not only an ABC broadcaster and Chairman of the Commission for the Future but is also President of the Australian Museum Trust. The Sydney-based museum administer the Eureka prizes which offer only modest cash awards, but have achieved excellent publicity.

The cachet of "Eureka Prizewinner" is now liberally attached to each of the six winners in four categories. Ten thousand dollars was donated each by the ABC (for the Promotion of Science award), POL Magazine (for Environmental Research and Science) and NSW University Press (for the new Science Book award). The Australian Museum Prize for Industry is all glory and no cash.

Reflecting the scheme's national character, the 1991 prizes went to Melbourne, Sydney, Canberra, Adelaide and Perth. Several women were among the 33 nominations and one scored an outright prize (in the new Science Book section). We know this because, unlike most other prize schemes in science, a list of all the nominees was released. The Eureka scheme thus gives credit to people and organisations worthy of prizes if there were more.

Communicators recognised

Two scientists who have gone out of their way to communicate their work to the public were rewarded with the ABC Prize which recognises outstanding achievements by scientists in bringing their subject to the people. (This is an award for professional scientists; science journalists are noted through the Michael Daley Awards.)

The main prize went to Professor Paul Davies, the mathematical physicist who was featured in the Terry Lane interview in the last edition of 21C. Davies migrated last year to the University of Adelaide as a vocal "refugee" from Margaret Thatcher's treatment of British science.

A prodigious writer of books and presenter of TV, radio and public lectures, Paul Davies' work in the popular media has not distracted him from continuing with research and teaching (he has 108 papers to his credit).

He is especially renowned for writing about the latest understanding of cosmology and the origin of the universe, boldly explaining complex and abstract concepts in everyday terms. Unlike most scientists, he is not deterred from tackling the philosophically thorny question of whether there is a creator/deity.

Building on the success of *God and the New Physics* and 18 other books, Davies has just launched another, *The Matter Myth*, with John Gribbin.

Reflecting his eclectic interests, at exactly the same time the Eureka Prizes were announced he was meeting the Pope in Castel Gandolfo, the Vatican Observatory in Rome, where he was taking part in a high-powered conference of physicists, theologians and philosophers



Dr. Ben Selinger: epitome of the publicly-engaged scientist.

sponsored by the Vatican.

He said: "My paper was on the mysterious issue of why the universe is understandable. We humans are privy to the secrets of nature when we have no special rights or evolutionary reason for doing so".

In his next book, *The Mind of God*, to be published early in 1992, he explores the connections between the laws of physics and mathematics and the existence of conscious observers. He asks: why do our brains generate mathematics capable of describing the laws of nature? Are our minds "geared" into

physics in some fundamental way?

The judges also awarded a special prize to well-known Canberra academic, Dr Ben Selinger, Head of the Department of Chemistry at the ANU in Canberra for the past three years.

Dr Selinger is the epitome of the publicly-engaged scientist. Not only has he been a tireless expositor and promoter of chemistry (his book *Chemistry in the Marketplace* is a classic and his newspaper articles and radio programs have entertained thousands), he has thrown himself into the application of science to everyday problems.

For many years Selinger, 52, has supported the consumer cause, while sustaining a rigorous degree of scientific independence. He has been a forceful critic of the sloppy use of scientific evidence in criminal trials, notably the Lindy Chamberlain case.

Now he has been charged with the nationally important and politically sensitive task of leading the Independent Panel on Intractable Waste set up by Victoria, NSW and the Commonwealth. He said yesterday that his panel's style will be consultative and open.

Oxford University Press has just published, worldwide, Selinger's *Thinking with Fourier*, an innovative program for learning how to analyse scientific data on the Macintosh computer.

Aussie solar cells to set the world alight

The Eureka Prize for Environment went to a Green, not an activist but an electrical engineer. The award to an engineer has symbolic importance - in the flurry of environmental action and reaction, it is seldom appreciated that pollution and the greenhouse effect cannot be cured by trading words, but primarily by applying solid science and technology to the problems.



Professor Paul Davies: a refugee who tackles thorny questions.

For all his career, Professor Martin Green, 43, has been an achiever - no hard sell, just solid results. Promoted rapidly through the ranks at the University of NSW, he was appointed, at the age of 38, to the first Personal Professorship in the Faculty of Engineering. He founded and directs the Centre for Photovoltaic Devices and Systems which boasts a \$2.5 million annual budget and a fulltime staff of 25, plus 25 associates.

What brought him the Eureka Prize is the development of the world's most efficient solar cells for converting sunlight directly in to electricity. The capacity of his cells was demonstrated dramatically when they powered Spirit of Biel to a 400 km victory in last year's Darwin to Adelaide race for solar cars.

Martin Green said: "This result was the most exciting thing for solar power. At 17 to 18 per cent efficiency of conversion, the commercial forms of the cells we designed were 25 per cent more efficient than the competition from overseas".

The winning commercial cells were produced by Telefunken in Europe, one of three overseas licensees of the UNSW technology which has also been licensed to the only two Australian manufacturers, BP Solar and Solarex, both of Sydney.

Now, the Green team has pushed the efficiency of the next generation of cells in the

laboratory, up to a record 23 to 24 per cent. They have done this by coating and grooving the rear surfaces of the silicon wafers, which form the basis of the cells, so that light is bounced back and forth within the silicon and none is lost.

They are working on transferring the laboratory techniques into a technology which can be used commercially. "Our target is achieving 20 per cent efficiency in commercial cells, a natural milestone, by March next year," Green said.

The long-term aim is the introduction of solar cells into large-scale power production, displacing the burning of fossil fuels and reducing emissions of greenhouse gases. Martin Green looks confidently to solar power contributing five to 10 per cent of power generation in 15 years.

Big and small industry rewarded

The value to industry of investment in research was acclaimed by the joint award of the Australian Museum Prize for Industry to Australia's largest company and one of its smallest.

Receiving the prize from CSIRO chairman, Neville Wran, were Mr Peter Laver, corporate general manager, technology and development of BHP Ltd and Dr Peter Keating, managing director for research and development of Biotech International Ltd of Perth.

The scales of activity could not be more different. BHP was recognised for putting \$100 million annually into R & D, an increasing proportion of which is being spent externally, principally with CSIRO and with universities.

Biotech International, a rare Australian-owned survivor among the biotechnology companies (down from 55 in Australia in 1986 to less than 10 now), employs 13 people and, according to Keating, ploughs "virtually all of its investment into research".

Laver said: "The Eureka



WORKS IN PROGRESS

Prize comes at a time when a new partnership agreement between BHP and CSIRO is helping both to sharpen up and learn fast how to focus research on commercialisation. The money going into CSIRO from us won't break our bank but we are seeing that it is miraculously getting the different divisions of CSIRO talking to each other."

Nominating some specific outcomes of the BHP/CSIRO arrangement, Laver said work is proceeding well in three areas: waste management, remote sensing and conversion of natural gas to liquid fuels and other useful products.

Biotech is successfully marketing a molecular biology test for tuberculosis which cuts the time for getting a result from 12 weeks to three hours. The same principles are being applied to developing a quick test for AIDS which will reduce the waiting time from six months to three to four hours.

In natural products, the Perth firm has begun converting the green algae found as slime in ponds into a health food, chlorella. Using ponds of bore water near Geraldton, the product, when dried and powdered, has very little contamination from metals. The first harvest is set for export.

Biotech is also producing chitin, an extract of the shells of crayfish and prawns which otherwise require disposal of a foul-smelling residue. Chitin is used in the cosmetics for hair treatment and in medicine for making artificial skin and drugs with sustained release.

Agricultural biotechnology is the third arm of Biotech's business. In this "blue sky" field of research, they are finding ways of harnessing fungi as "friendly guard dogs" to help in eliminating dependence on chemical control for diseases which cost Australia \$400 million a year in lost production.

Keating says the results of field trials with cereals are in their third year and are very encouraging. "If this technique is successfully introduced, we'll have the first broad-acre biological control in the world", he claimed.

"I hope the Eureka Prize will alert Australian investors to the quality of R & D here and will change their 'scratch and match' attitudes to risk.

"Because of relatively low pay for scientists here and losing brains overseas, our costs of R & D are quite cheap, so we can compete effectively from Australia. We are waiting for Australia to pull

its head out of the sand. The country is stalled for lack of investment capital."

Desert book

The first Science Book Prize was awarded to *The Centre*, a volume on Australia's desert regions written by Penny van Oosterzee and stunningly illustrated by photographer Reg Morrison.

An enterprising biology graduate, van Oosterzee is now running her own safari company from Alice Springs and also working for a PhD on the marsupial mole. She has produced the first natural history of the centre of Australia.

To cover the typical ecosystems of Australia's deserts, van Oosterzee traces the course of the Fink River "from the rugged almost impenetrable flanks of the MacDonell Ranges to the great ribs of the Simpson Desert". Throughout the book she produces evidence of a varied animal and plant life which gives the lie to the myth that Australia's centre is a "dead heart". *The Centre* is published by Reed Books (\$39.95).

Running the Eureka scheme was simple, smooth and uncontentious. The Australian Museum used nominees, assessors, staff and a small selection committee.

The four Eureka awards cost a total of \$40,000 (all donated). The budget for travel, trophies, printing and promotion was a mere \$8,000.

Cannibal star planet puzzle

The chance of life occurring elsewhere than on Earth was increased greatly by the announcement in July of the first planetary system to be detected outside the solar system. Three radio-astronomers, including Australian Dr Matthew Bailes, used the Jodrell Bank telescope in Britain to find regular variations in radio bleeps from a pulsar 30,000 light years away from Earth, known only by its catalogue number PSR 1829-10. (A light year is the distance travelled by light in one year, equivalent to 10 million million kilometres.)

The planetary system is so far away that it cannot be observed directly. The Jodrell team concluded the variations were caused by the rotation around the pulsar, once every six months, of a planetary object.

The news generated great interest in the media around the world and rapidly became controversial as some astronomers doubted the conclusion that a planet was indeed being observed.

This scepticism was fuelled by the speculations of the observing team as to how the planetary system came into being. The puzzle was that

the nest, taking over the existing system", said Rees.

Calculations show the near-circular orbits of the planets would be elongated in the collision process but after the system settled down they would return to normal because of drag forces. Meanwhile, the neutron star would be re-activated as a pulsar and its bleeps (three



Dr Matthew Bailes: a nearly circular orbit for new planet.

pulsars are believed to be the product of a massive, supernova-type explosion which would have devoured any circling planet or dislodged it from an orbit, and it would have escaped from the system.

More recently, several theories have been put forward to explain the observations. One of the most imaginative has come from Professor Martin Rees and colleagues of Cambridge University. They proposed in the international science journal, *Nature*, that the starting point is a solar system rather like our own, with a central star surrounded by a planet or planets.

This theory was described by Rees as "fun and most entertaining". They suppose that a wandering neutron star invaded the system and passed so close to the "sun" that it cannibalised it, generating such energy that it puffed up and engulfed the orbiting planets.

"The planets would have a bad time of it over 100,000 years but most would have survived. It's like a cuckoo in

times a second) would vary in a regular fashion as the rotation of the planets caused wobbling in the pulsar, just as observed by the radio-astronomers.

This theory allows for the existence of more than one planet in the system, which the original discoverers suspected. The Cambridge scientists also put up an alternative theory. In this, the pulsar could have been formed from two white dwarfs (stars nearing the end of their evolutionary life) in a "binary system".

Such a system, in which two stars circle around each other, is found quite commonly in the universe, but in this case the scientists say the stars may have come so close that they spiralled together and coalesced into one.

The resulting object would have been so massive that it was unstable. Some of the material would have collapsed into an immensely dense ball of neutrons which, on rotation, formed a pulsar, as found at the centre of the new system.

The remaining material

would have spun off into a disc of hot gas from which the planet (or planets, as there is some evidence of more than one planet existing in the system) would have been formed.

Said Rees: "Whichever of the two explanations proves the more likely after further observations, it must be a rare event and this is good news for the solar system because the pulsar/solar system would be most unlikely to be able to support life as we know it on Earth due to intense radiation from the pulsar".

Nonetheless, he believes the feasibility of the two theories "strengthens the evidence for many solar systems, and hence of life-supporting planets, existing in the universe".

This particular planet is too far away to be observed directly and is bathed in such intense radiation that life, as we know it, is unlikely to exist on its surface.

The planet's existence was deduced from accurate measurements of the radio bleeps received from a rapidly rotating neutron star (a pulsar only 30 km across and consisting of such dense material that a sugar cube of it would weigh 100 million tonnes on earth).

It lies near the centre of our galaxy, the Milky Way, about 30,000 light years from Earth. Calculations show the planet is rotating in a nearly circular orbit around the pulsar once every six months at about the same distance as Venus is from the Sun (107 million kilometres - Venus lies between the Earth and the Sun). The planet is 10 times the mass of the Earth.

Bailes said PSR 1829-10 was one of 40 pulsars being studied by the team. Thirty-nine of them fitted conventional explanations of pulsar behaviour but the 40th had what is called a "sinusoidal variation" in the precise timing of its pulses. This is exactly what would be expected if a planet was circling the pulsar and causing it to "wobble" (the Sun, too, moves in response to the motion of its planets).

The team then observed the pulsar every day they could get time on the telescope for 18 months, finishing with continuous observations for a month to confirm the planetary hypothesis. Bailes said PSR 1829-10 "has a beautiful constant amplitude and we are confident of our conclusion."

Dr Peter Pockley is a science writer and broadcaster based in Sydney.

BOOBOOK AND EARTHSCAN CARING FOR THE EARTH



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Haydn Washington

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Robyn Williams, *The Science Show*, ABC

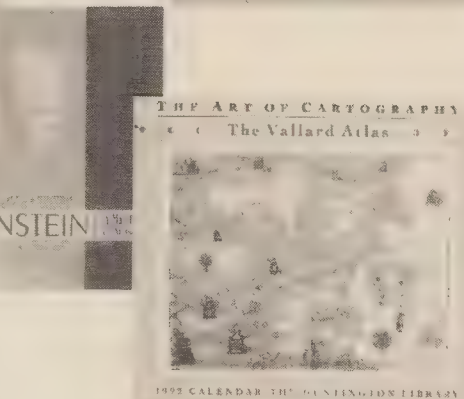
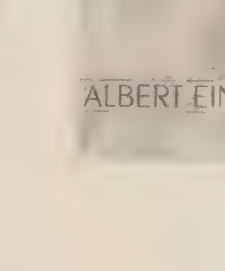
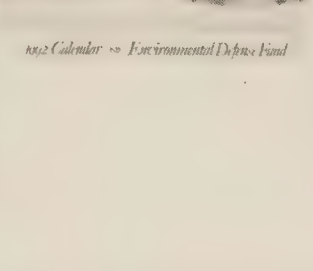
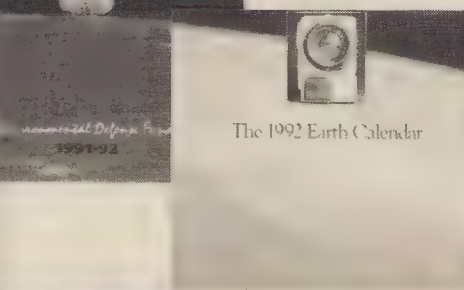
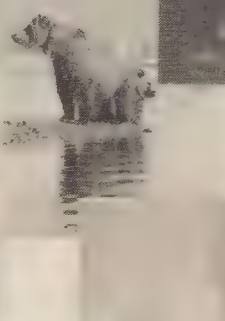
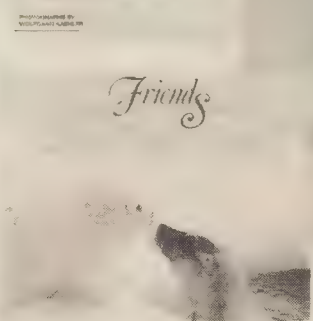
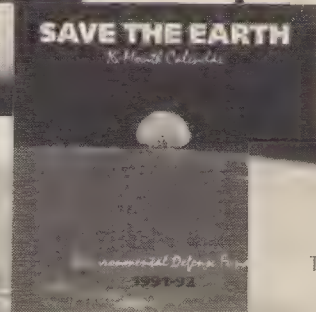
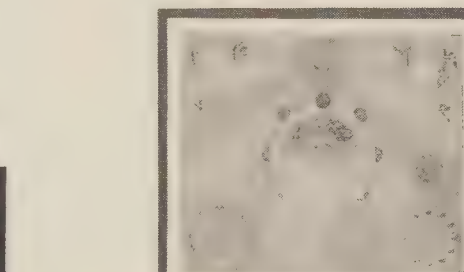
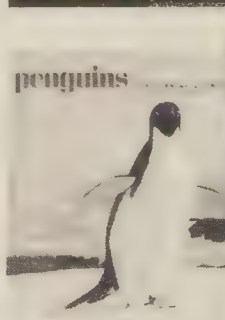
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HINDSIGHT

A better world for women only

Picture a world where women live without men, reproducing daughters through selective parthenogenesis. Charlotte Perkins Gilman envisaged such a utopia almost 80 years ago.

Around the globe, sexism still rules. Equal opportunity, for all its logic, still exists only in the minds of its proponents. Back in 1915, as men marched off to a World War started by men (and women waved them goodbye) Charlotte Gilman put some of her forward-looking ideas together in a novel called *Herland*.

Gilman's view, according to the introduction to the modern edition, was that "the most important fact about the sexes, men and women, is the common humanity we share, not the differences that distinguish us. But women are denied autonomy and thus are not provided the environment in which to develop. Men, too, suffer from personalities distorted by their habits of dominance and power. A healthy social organism for both men and women, therefore, requires the autonomy of women."

Hence the notion of a world without men. Gilman's aim was to provoke. By using the innocent logic of women in a world all their own, she aimed to highlight the blind stupidity of gender injustices accepted as normal behaviour then, and now.

The plot was simple: three male explorers in search of adventure find themselves in Herland. For generations, the women in this community have lived in peace and harmony,

reproducing without men.

The men are shocked to find themselves treated as people, and disturbed to think that any society could function efficiently without conventional male domination. One character, Van, says: "This is a civilised country... There *must* be men." The women, coping admirably, relate to these strange interlopers as friends, and only as friends. Their broad community approach is socialist, and revolutionary by the standards of 1915.

As the introduction puts it: "The women of Herland do not understand why somebody else's name should be taken after marriage; why dead bodies should be put in the ground to decay; why long hair is considered womanly by men when only male lions and male buffaloes have manes; why loved pets are imprisoned on a leash and why they are allowed to bite children and why they are permitted to leave their wastes on streets where people walk; what women in the outside world do all day long if they do not work; why women with the fewest children seem to have the most servants; why a God of love and wisdom has left a legacy of sacrifice, the devil, and damnation; why God is personalised at all - they do not believe in a Big Woman somewhere but rather a Pervading Power, an Indwelling Spirit, a Maternal Pantheism; why people who are emotionally ill, such as criminals, are punished, when people who are physically ill are not; why ideas from thousands of years ago should be cherished and honoured."

Terry, another of the adventurers, complains that even the young and beautiful

women "are unfeminine because they lack the qualities of deference, girlish charm and fragility." Barbara Cartland, beware.

Despite the lack of sexual tension, Boy does meet Girl in a relationship built on mutual respect.

Meanwhile, Gilman's gentle mocking throughout pokes fun at foolish conventions. At one stage, Terry attempts to explain the advantages of competition, without which there would be no stimulus to industry.

"No stimulus to industry," they repeated, with that puzzled look we had learned to know so well. "Stimulus? To industry? But don't you like to work?"

"No man would work unless he had to," Terry declared.

"Oh, no man! You mean that is one of your sex distinctions?"

"No indeed!" he said hastily. "No one, I mean, man or woman, would work without incentive. Competition is the - the motor power, you see."

"It is not with us," they explained gently, "so it is hard for us to understand. Do you mean, for instance, that with you no mother would work for her children without the stimulus of competition?"

No, he admitted he did not mean that.

These days, men are still not saying what they do not quite mean. The process of achieving equality is still going on, with successes matched by setbacks, and is likely to

continue beyond even the 21st century. Unless, perhaps, science comes up with a method of parthenogenesis, so that women can live without men... it's an intriguing prospect.

For Gilman, a writer and



lecturer celebrated in her time but less well known in ours, the news that she suffered inoperable cancer added a new dimension to her vision. In 1935, after farewelling her family, she used chloroform to end her life. The note she left reads:

No grief, pain, misfortune or "broken heart" is excuse for cutting off one's life while any power of service remains. But when all usefulness is over, when one is assured of unavoidable and imminent death, it is the simplest of human rights to choose a quick and easy death in place of a slow and horrible one... I have preferred chloroform to cancer.

Herland was republished in 1979 by The Women's Press.

Holiday reading

THE AGE OF INTELLIGENT MACHINES

Raymond Kurzweil
The MIT Press

A big, colourful look at the world of artificial intelligence. Unlike many books in this field Kurzweil has come up with a provocative and captivating profile of the field of the future. Available through Manic Exposure; (03) 416 2050.

THE NEW HACKER'S DICTIONARY

edited by Eric Raymond
TECHNOBABBLE
by John A. Barry
The MIT Press

Two books which look at the effect that technology is having on the English language. The New Hacker's Dictionary is a comprehensive listing of the bizarre slang used by today's computer hackers, from Flarp to Spoooge to Zorch.

Technobabble, while not as entertaining and humorous, is a seriously informed look at the influence of technology on the language. If you enjoy Stephen Knight's article on the future of English in this edition of 21•C, then both books are required reading. Available through Astam Books; (02) 550 3855.

ANTARCTICA: Private Property or Public Heritage?

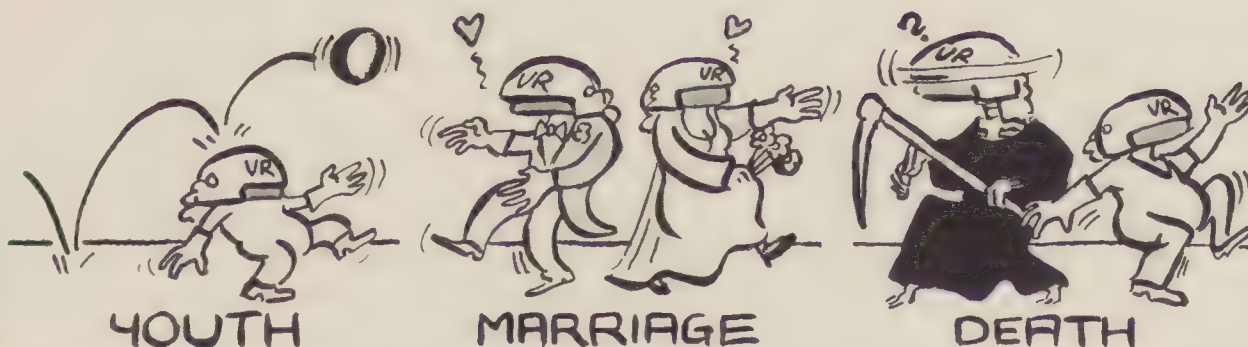
by Keith Suter
Pluto Press Australia/Sed Books

Antarctica represents one of the world's last remaining wilderness regions. It is, however, under threat following the failure of the Antarctic Minerals Convention which Australia and France refused to sign. Keith Suter's study of the region offers some fascinating insight to the region and suggests some imaginative solutions to secure Antarctica's future.



DYSONETICS

A
LIFETIME
OF
VIRTUAL
REALITY



Dr Strangelove's revenge

Australia shows serious symptoms of alienation from science, particularly the tougher subjects. Why are young people turned off from science in droves? Why is science so badly taught? Why the depressing circularity of low esteem — low rewards, and so on?

These are the symptoms:

- A declining number of scientific vocations, especially in physics, chemistry, mathematics and engineering.
- The difficulty of attracting quality candidates into science teaching.
- The lack of scientific and mathematical background (or commitment) in primary teachers, which has a lifelong impact.
- The remoteness and/or hostility of politicians and bureaucrats from understanding science and scientific methodology.
- The remoteness of scientific practitioners from the political/bureaucratic process and the difficulty of finding a common ground to discuss what ought to be issues of mutual concern.
- The "dialogue of the deaf": problems of mutual incomprehension between advocates of market force economic policies and budgetary allocations, with their emphasis on the short-term, and promoters of a long-term effective scientific base, with enough flexibility and critical mass to enable internationally credible levels of activity.

There are some significant intellectual and psychological barriers, both to understanding science and technology and relating to it.

1. Complexity and super-specialisation.

Science was the subject of intense popularisation until the Second World War, and *Popular Science* was a best-selling magazine in the US. Right through the 19th century and well into the 20th, the exposition of science and its impact on life was a highly visible intellectual activity. Humphry Davy, Michael Faraday, Joseph Henry, T.H. Huxley, William Bragg, James Jeans, Arthur Eddington, and Julian Huxley were accomplished lecturers and popularisers. This honourable tradition has largely disappeared. Carl Sagan, Stephen Jay Gould, Steven Weinberg, Stephen Hawking and David Suzuki are exceptional. Scientists are now ultra-specialised, hermetically sealed off not only from the community, but often from other practitioners in related disciplines. They use their own language, which is another limiting factor.

In the golden days of popular science it was possible to appeal to large audiences by explaining "this is how electricity works" at an essentially functional level: "This is a telegraph, a microphone, a radio, an X-ray machine. This is how the internal combustion engine, the motor car, the aeroplane, the submarine work."

Part of science's strength at this

time was its ability to bring understanding to people in general — to show how the universe works and how inventions have brought about major changes in their lives.

Part of the present weakness of science as a political and/or cultural factor in the age of Dr Strangelove is its psychological remoteness: the audience no longer relates. Where 19th century popular science appears to say "the structure of the universe is infinitely mysterious", the more we explore, the less confident we can be about our capacity to provide meaning.

Typically we downgrade the importance of things we do not understand. Politicians and bureaucrats who might have been reasonably confident of their layman's grasp of how the motor car worked, or the significance of penicillin or DDT have nothing whatever to say about the significance of microelectronics, computers, information theory, subatomic particles, superconductivity, DNA, RNA and molecular biology. Since they don't even pretend to understand any of these but are naturally unwilling to confess ignorance, the Avoidance Syndrome comes into operation. "Rejectio, ergo despicio", as Descartes might have said.

2. Science remote from the public culture.

Science is not yet part of our political or public culture. Ministers for Science, as I know from my own experience, usually live in political Death Valley and can't wait to be called out of it. Rhetoric aside, senior politicians often sound as if they are reading a brief when they talk about scientific and technological issues. Science meetings, in my experience, invariably occur when heads of governments are very busy elsewhere. Science is at a polar extremity from sport, a subject which has a high dramatic content, strong identification with teams of onlookers, and a speedy outcome, leading to catharsis, and is extremely easy to photograph, film and report. Where is science in the corporate culture? On the periphery, at best.

3. The psychological barrier.

Because of increasing complexity and remoteness in science, citizens are unable to form an independent judgement about new discoveries, how and why they are important, and whether they are now worth funding. They must rely on experts to tell them. Essentially the judgement of the expert is accepted on faith alone. Science can no longer be understood through appeal to common sense. Common sense and everyday observation tell us that the sun rises in the east and sinks in the west, that the Earth is flat and forces don't operate at a distance. In the past, these observations were psychologically satisfying because people could rely on their own

observations. Then the expert came along and said: "Trust me. Your commonsense observations are worthless. You must rely on my authority because you cannot test for yourself what I tell you." This denial of reality is inevitable with complex areas like quantum physics or subatomic particles — but it helps to explain why citizens don't show much empathy for science.

4. History of science taught as "success story".

The history of science has been very badly taught at school (if at all). It is seen as a steady, single-minded pursuit of truth — as linear

projection based on gradual accumulation of knowledge. But science does not grow by accumulation. Much great science is demolitionist, destroying the accumulated wisdom of the past, for example the work of Copernicus, Galileo and Kepler in demolishing the Ptolemaic paradigm of the universe, or the work of Harvey and Malpighi in

refuting the anatomy of Aristotle and Galen.

There have been revolutionary shifts, often very passionate and bitter, in cosmology, evolution, psychology, geology (eg "continental drift"). The nature versus nurture debate still goes on. Value and belief systems have been deeply involved in paradigm shifts, as Thomas S. Kuhn called them. By seeing science as a smooth inevitable progression, we take away its excitement and appeal. The dogma of technological progressivism (or even "triumphalism") with its emphasis on "more", "bigger", "faster" has some repellent sides, has alienated the young and is not a feasible model for the Third World. The US finds it very hard to grasp this.

5. The decline of the "big picture".

Like historians, scientists can be divided into two groups, the "lumpers" and the "splitters". Lumpers try to bring disparate pieces of evidence together and form some broad generalisation. Splitters see this as a very dubious proposition: they prefer to keep specialising and dominate a particular area of knowledge. Lumpers are now very much out of fashion. Very few senior scientists try to relate their work to the "big picture." Fashions change. In the 1930s physicists such as Einstein, Bohr, Helsenberg and Shrodinger were widely read in philosophy and saw their own areas of expertise within a context of epistemology. The great debates of the time, for example between Einstein and Bohr, would be virtually impossible now, where physicists concentrate on their own narrow areas and rarely step outside them. Even the "cold fusion" controversy of 1989 fizzled out without adequate discussion of the major issues involved. Psychologically the eclipse of the "big picture" means that people feel unable to understand and empathise with science, to feel that it

involves them, and that there are issues to be excited about.

6. The invisibility of science. In sharp contrast to politics, sport or the arts, science is essentially a faceless activity. Going into science may well be the 20th century equivalent of running away to sea. It is obscure, remote and poorly paid. Many scientists are poor communicators and want to be left alone to get on with their work, waiting only for the cheque to be pushed under the door.

7. Negative reactions to science/technology and the "big fix".

Technology (and science) is still linked in the public psyche with atomic weapons and delivery systems. Although Cold War tensions have mercifully disappeared, the imagery of the mushroom cloud remains in our heads. Technological horrors at Mexico City, Union Carbide's plant in Bhopal, the failure of Chernobyl remind us that technology can exact a high human price if and when misused. Concern about nuclear waste, acid rain, intractable waste have all had adverse effects on attitudes to science. Dr Strangelove is still in evidence. Concerns about environmental destruction, loss of species diversity, the prospect of global warming through the Greenhouse effect, are often linked to technological development and contributes to an anti-science mood.

Labour-saving devices produced by technology have an immediate appeal — they enable us to go further, faster and do more things in the same amount of time. Technology is also feared (exaggeratedly) as a threat to employment and, through it, self-worth.

8. Supersaturation.

We are now surrounded, from infancy, by sophisticated technology, either experienced directly (transistor radios, automobiles, word processors, minicomputers, CD players, computerised cameras, television, videos) or observed through media (war weaponry, lasers, Star Wars technology). Where is the mystery in a digital watch which can be bought for \$5 then thrown away? In the film *The Gods Must Be Crazy*, a bushman is fascinated by the first technological artefact he comes across: a Coke bottle. We have long passed beyond the "first, fine, careless rapture."

9. "Science can be fun"? I welcome the development of science and technology centres, something that began with Frank Oppenheimer's Exploratorium in San Francisco. But there may be built-in limitations to overemphasising the "fun" aspects, as if science is just another form of consumption and entertainment. Certainly dinosaurs are extraordinary, and a "gee whiz!" response is understandable. But how much better if the examples of the dinosaur (or the environment) help the audience to relate, to empathise, to understand the process of change, and adaptation to it, to be able to initiate discussion (as in La Villette, the "science and industry city" in Paris) and not just be passive.



BARRY JONES

Report by the World Commission

on Environment and Development

on the critical environment pro-

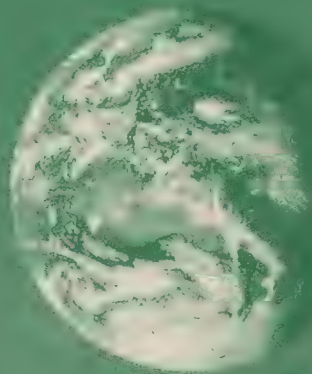
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USE YOUR INITIATIVE



Enterprise skills for the future

A yodel with disturbing echoes

It's rich, it's clean, it's safe, it's beautiful and it's successfully multicultural. A portrait of Australia in 2001? We may hope so, but actually it's a description of Switzerland now.

There's clearly much we can learn from the land of the fondue and the cuckoo clock. But Switzerland is also one of the strangest nations I've ever visited, and that's the real reason I'm writing about it now. I've just returned from a week's intensive study of Swiss behaviour in its 700th anniversary year, organised for me by the Swiss Government (and

a rifle at home, so he can be mobilised instantly into the army if there's an invasion threat. "Oh certainly," Mr Schafer said proudly. "I have 10 guns at home, because I'm a captain in the army."

I remarked that in Australia, there was some concern about the easy availability of guns, and asked if there wasn't a risk that people would use their guns for crime, or go mad and commit mass murder. Mr

Schafer looked puzzled. "A Swiss would never use his army gun for crime," he said. "It's the ethic. If you were going to commit a crime, you would get another gun. Except for suicide, of course. People sometimes use their army guns for that."

When I reached Lucerne, I was told that I'd just missed a great annual shooting festival in which 12-year-old boys demonstrated their prowess. Naively, I asked if these children were using crossbows. "No. Rifles, of course," was the reply. Some Swiss argue that the army is the only thing that keeps their diverse nation together. Because all Swiss males are part-time soldiers and spend a couple of weeks a year training for "the defence of the Fatherland", whether they live in the Italian, German, French or Romansh speaking parts of the country, they develop a loyalty to a concept that would otherwise be very hard to define.

The Swiss women I spoke to tended to be more sceptical about the army. Some see it as just an excuse for boys to get together and play games, and as a way of stifling individualism. The Swiss were shocked by the results of a recent referendum in which 35 per cent voted in favour of abolishing the army. In a typically Swiss spirit of compromise, the anti-army voters are to be appeased by a proposal to reduce the compulsory training time, cut spending on military equipment and provide alternatives to imprisonment for conscientious objectors. But every man will keep at least one gun.

The ultimate democracy? The Swiss can be called upon to vote as often as eight times a year – for their central government or their canton government or their district council, or in the various local and national referendums. Usually less than 40 per cent of eligible voters bother to participate. One Swiss I spoke to said he rarely votes because no matter what you do, everything always stays the same in Switzerland.

The central government has been the same coalition of four parties, representing 80 per cent of the voters, since 1959. It is hard to see how the Swiss could ever throw out a government with which they were



DAVID DALE

unhappy, since there is no alternative government in the sense Australians understand it. But then the national government, the 26 cantonal governments, and the 3061 local councils (yes, 3088 governments for a population of six million) consult the citizens regularly via referendums, and if the politicians fail to put an issue to the vote, a petition of 50,000

signatures can initiate a referendum anyway.

When I was in Lucerne, the populace was about to rule on the design of a new cultural centre, and there was much debate about whether the most spectacular of the three proposals intruded too far onto the lake. The woman describing it to me – well informed on international affairs, as most Swiss seem to be – wondered whether the Sydney Opera House would ever have been built if the design had been subject to a public vote. In Geneva, the citizens were voting on a proposal to upgrade their international airport. In Australia, governments just go ahead and do things. In Switzerland, they can't.

Public transport paradise? The Swiss love their trains and boats and trams and buses and funiculars and light rails. They also spend a lot on cars, but as one Swiss explained, more as status symbols than as a way of getting around.

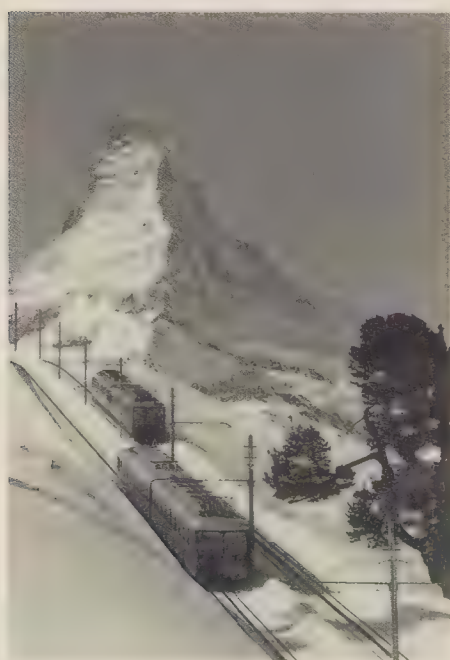
Not content with the most efficient public transport system in the world, they're now talking about a metro that would run under the entire country,

different from the Australian or possibly loses something in the translation, but the best joke I was told there went like this – a German, a Frenchman and a Swiss were discussing where babies come from. The German said: "Everybody knows that the stork brings them." The Frenchman laughed, and said: "In France we know that babies come from a man and a woman making love." They turned to the Swiss and asked what he thought. He said: "In Switzerland, it varies from canton to canton."

The Swiss are proud of their internal differences, and work hard to maintain them. For example, the central government heavily subsidises the remote mountainous area in the south east, inhabited by the speakers of Romansh, because there's a natural tendency for the young people to drift to the big population centres in search of work or excitement, and to lose their cultural identity. There are five newspapers published in the Romansh language – a good choice for a population of 40,000 people.

But there seems to be an essential Swissness that transcends linguistic differences. Visiting Locarno, in the Italian-speaking south, I made the mistake of thinking the place looked and felt like a typical village in Italy. As I wandered through the crowded cobbled streets with an official of the local tourist authority, he pointed to a large metal tube on the road and said: "That's our air pollution monitoring system. As soon as the pollution gets above a certain level, we close this part of town to cars." Such logical planning would, I suspect, be impossible in Italy.

At lunch, the menu contained



William Tell, the Swiss national hero, still has a symbolic meaning which has its historic roots in the rebellion against oppression of foreign powers.

you ain't seen an exhaustive itinerary till you've seen a Swiss itinerary). What you're about to read represents the first random sorting of my experiences.

The Swiss have one characteristic that seemed very Australian to me – they are self-critical to the point of self-abuse. They tend to begin conversations by saying: "We're very dull people here – you won't find anything to write about us", and then go on to anguish about drug abuse, AIDs statistics, and Calvinist conformism. This determination to be realistic was symbolised in a press release I received from the Swiss National Tourist Office. Under the heading "William Tell" it said: "Switzerland must be the only country to have a national hero, known the world over, who did not exist."

I'm sorry, I do not wish to know about that. The British would never destroy our illusions about Robin Hood and King Arthur, and such a revelation about William Tell is needlessly brutal. The Swiss are wrong about themselves. They are, in fact, fascinating. Witness...

A gun in every home? In conversation with Max Schafer, vice-president of the Union Bank of Switzerland, I asked if it was true that every Swiss male over 20 had to keep



The Swiss Army life: "A Swiss would never use his army gun for crime."

from Geneva in the south west to St Gallen in the north east, and from Bellinzona in the south east to Basel in the north west.

At close to 500 kph, these trains would cross the nation in three hours, in underground tubes where a partial vacuum can be created to reduce air resistance. And after that, an extension into a Eurometro that might link Paris with Milan or Madrid with Berlin? Of course, the scheme will have to be put to a referendum.

A model of multiculturalism? The Swiss sense of humour is somewhat

typically Italian dishes. But the antipasto table was cleared away at 1.45, and everybody was preparing to return to work at 2. When my pasta arrived, I asked for a pepper grinder, and the waiter went in search of one. My companion was curious. "You want to grind pepper on your pasta, do you? The Italians always do that. And will you want to put a lot of olive oil on your salad?" I nodded. He became reflective: "This is interesting. I think you Australians must be more like the Italians than you are like the Swiss."

Satellites and sea levels track Greenhouse effect

BY IAN ALLEN

Rising sea levels are one of the widely predicted consequences of the Greenhouse effect, but prediction is one thing, gathering hard evidence is another. Because the annual increment in sea levels is so small, getting an accurate fix on it means pushing technology to the limit.

There is no such thing as truly "solid ground". The Earth's crust is a series of giant tectonic plates floating on a dynamic and plastic core. There is motion even within the continental plates, with some parts rising and falling relative to each other. Coastal areas regularly rise and fall with the tides, compressing under a high tide, and expanding under a low one.

How then are we to make meaningful measurements of global sea levels? Is the water rising or the land falling? A difficult question complicated because the entire continent keeps moving. Each year Australia is about seven centimetres closer to Japan. Against this background of constant motion, the scientific challenge is to find ways of accurately discerning extremely small changes in sea levels, as little as one millimetre per year.

The essence of the problem is to find ways to accurately fix in space the positions of a network of tide gauges. There is no existing technology which can provide all the answers, but in a 20 year experiment Australian scientists are combining a number of positioning systems which, in half that time, should give us some hard data on just what is happening to ocean levels.

In any position fixing system you need a reference point. For sea level monitoring, there is no point on the Earth's surface which is reliably constant. About the only constant we can be sure of is the position of the centre of the Earth, and that's exactly the reference that has been employed. Knowing the precise centre of the Earth is not as difficult as it seems, because it is the key factor affecting the orbit of satellites. By accurately tracking satellites we can infer the centre of the Earth.

Satellite Laser Positioning is a technique which uses a laser coupled to a precise clock, and satellites equipped with special prismatic mirrors. The mirrors are similar to the

reflectors on a bicycle in that they always reflect light back in the direction from which it came. The laser is pulsed at the satellite and the time delay for the echo measured. Combined with light speed, the delay translates into a precise measure of the distance between satellite and observer. Combine that with knowledge about the satellite's orbit and it is possible to accurately fix the observation point's distance from the Earth's centre.

The limitation with this technique is that the laser and its support hardware are not portable. Australia has two stations: one at Yarragadee near Geraldton, WA (which is run by the US), and one near Canberra (Auroral Valley) run by AUSLIG (Dept of Admin Services). What SLP does offer is two precise reference

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points on Australia's continental surface. The tide gauges then need to be related to them.

To do this, the second technique employed is the Global Positioning System, which also uses a system of satellites. GPS was originally designed for military use, and its primary purpose is to fix locations on the surface of the Earth. It works by comparing signals from at least four satellites. More need to be launched before it can be used anywhere in the world at any time, but even without 24-hour coverage it is already widely used in maritime circles. It can fix a boat to within 100 metres, but by using multiple GPS ground units, even greater accuracy can be achieved.

Earth Sciences at the Australian National University, The University of NSW, TAFE and the NSW Department of Lands each have one portable GPS unit. Using the four units

together gives optimal accuracy. The four GPS systems can be used to link the two precisely known SLP positions to tide gauges up to 1000km away, with horizontal resolution to about one centimetre and vertical resolution to three centimetres. The vertical resolution is still not good enough for monitoring tide gauge positions, but scientists are confident that the accuracy can be increased by six orders of magnitude.

According to Chris Rizos of the University of NSW department of surveying, within two years they should have the precision they need.

Satellite Laser Positioning and GPS are not suitable for intercontinental positioning. To integrate the whole global network, Very Long Baseline Interferometry is being used. VLBI is a technique where you take a distant object like a quasar and use precise clocks and differences in the phase of the received signals to work out the relative position of the two or more receiving antennas. It does not require a huge dish. The Australian telescope is being used, but so is Hobart, Tidbinbilla, and soon even the remote sensing disc at Alice Springs. VLBI is very accurate over long distances. It can fix Australia's position relative to Japan within one centimetre per 1000km. As the continent is moving north by about seven centimetres a year, the technique can, over time, pick up the motion.

By having accurate real time information on the water levels around the coastline, it may well be possible to make longer term predictions of weather. It may, for example, be possible to predict phenomena like the El Nino/Southern Oscillation up to 12 months in advance.

Australia has committed to installing a network of 11 monitoring stations in the South Pacific. We are also installing a network of eight around the Australian coastline. The entire project is being co-ordinated by the National Tide Facility at Flinders University. As well as fuelling our own research, the data collected will be sent to the US National Oceanographic and Atmospheric Administration (NOAA) which is co-ordinating the entire international effort to monitor global sea levels.

Ian Allen is a producer with Quantum.

J A P A N ,  I N C .

> Virtual reality is virtually here. Already Fuji TV, Japan's leading commercial network, presents a weekly science show called Einstein which has a set generated by chromakey and computer graphics. The two women hosts are among the first people to have virtual reality as their workplace. And at the Matsushita showroom in Tokyo, families don futuristic helmets, jackets and gloves so they can move among simulated kitchens, interacting with the various design elements. The next step: to recreate appropriate acoustics, lighting and ventilation so that simulated living contributes to some very real sales.

FOCUS JAPAN

> **Converting exhaled carbon dioxide into oxygen will be a key to living in space. A research team at Waseda University believes they are close to developing an enclosed gas recycling system which will allow about 100 people to live for a long time in a large space station. The system concentrates by about 100 times the CO2 with a solid amine adsorbent. This is then converted into water, carbon and methane. The carbon is stored, the methane discharged and the water converted into hydrogen and oxygen by electrolysis. By repeating these operations, CO2 is converted into oxygen artificially, as in photosynthesis. The living space for 100 people would be of a size equivalent to 20-25 buses.**

NEW TECHNOLOGY JAPAN

> A futuristic new ship, powered by electromagnetic force instead of screw propellers, is being tested. Mitsubishi's Yamato 1 has an overall length of 30 metres and will carry a crew of 10. With no rotating parts, the superconducting electro-magnetic ship features easy maintenance and freedom from noise and vibration. An internal system generates a magnetic field in seawater passing through ducts running from bow to stern. A compact helium freezer maintains the magnets at cryogenic temperature (-269 degrees centigrade).

NEW TECHNOLOGY JAPAN

> **Japan's National Research Institute of Aquaculture has succeeded**

in cloning rainbow trout and salmon by applying femininity generation technology.

Commercialisation of this technology would mean that fish with excellent shapes and succulent flesh can be mass produced. In femininity generation, sperm with destroyed chromosomes are used and only female chromosomes of the egg are present in adult fish. The technology is convenient for breeding because in halibut, for example, the female is larger than the male.

NEW TECHNOLOGY JAPAN

> Japan's Federation of Economic Organisations has decided on a Global Environment Charter of 11 items.

1. Drafting of corporate management policies relating to environmental issues.
2. Appointment of officers in charge of environmental preservation, establishment of environmental preservation-related regulations, and checking the results once a year.
3. Making efforts to alleviate adverse influences currently impacting on the environment throughout the industrial process, from product research to manufacture and distribution.
4. Development of technologies for the attainment of energy and resources conservation.
5. Transfer of environmental preservation technologies to domestic and foreign enterprises.
6. Making efforts to minimise environmental disruption accompanying inadvertent disasters.
7. Attaching greater importance to public relations and activities increasing public awareness.
8. Active participation in the environmental preservation activities of regional societies.
9. Giving due consideration to environmental preservation measures even when engaging in overseas business.
10. Supply of information relating to environmental preservation measures to related administrative authorities and international organisations.
11. Active co-operation in research to clarify and illustrate the causes and problems related to the Earth's gradual warming.

SCIENCE & TECHNOLOGY IN JAPAN

INTERVIEW

The breakthrough to understanding

A new book about anthropology and the future seeks to explain the essential behaviour we call human. Author JEREMY GRIFFITH answers some questions.

Should we be pessimistic or optimistic about the future of the human race on Earth?

The human species has been locked in a race between self-destruction and self-discovery. Humans have been waging a great battle against ignorance – ignorance of our true goodness as a species. The race was to find understanding of this greater truth of our goodness before our planet was destroyed by all the anger, egocentricity and alienation that resulted from us having to live with an undeserved sense of guilt.

What I'm saying is that the real battle on Earth has been a psychological one. Humans are capable of immense love and sensitivity but we have also been capable of extreme greed, hatred, brutality, rape, murder and war. Are we essentially good, and if so, what is the cause of our evil, destructive, insensitive and cruel side? The eternal question has been 'why evil'? Does our inconsistency with the universally accepted ideals of love, co-operation and selflessness mean we are essentially bad? Are we a flawed species, a mistake – or are we possibly divine beings?

Insecure in our goodness and aware of our badness, humanity has, through the ages, struggled to find meaning in the awesome contradictions of the human condition. We desperately needed a clear biological understanding of ourselves, understanding that would liberate us from criticism, lift the burden of guilt, give us meaning, bring peace to our troubled minds and lead us to achieving our psychological maturity as a species.

Our hope and faith that we would one day liberate ourselves from ignorance has been fulfilled. Humanity now matures from its insecure adolescence into secure adulthood. Enormous relief, excitement, optimism and fellowship emerge now. On the death-knell we have broken through to understanding.

What then is the answer to this question of questions of the origin of so-called Sin?

In my book I explain that the human condition of having to live with an undeserved sense of guilt developed when our conscious mind emerged some two million years ago. At that time, a battle began between the conscious mind and our instinctive self that could only be resolved through an understanding of the difference between consciousness and instinct. The conflict arose because the conscious mind is a memory-association-based learning system, which means it is insightful or understanding, whereas instincts are derived from the genetically-based learning system, which is not insightful.

By the time the conscious mind emerged, we had already acquired an instinctive orientation to the ideal of being co-operative. Of course, this was not a conscious understanding of that ideal. The battle began when the conscious mind embarked on the necessary journey to find understanding of that ideal and everything else in life. Unavoidably and tragically, the instinctive self criticised the search because it was not able to recognise and tolerate the misunderstandings and mistakes that the conscious mind made while trying to find reasons for everything. To find understanding, the conscious mind had to defy the ignorant criticism levelled at it by the instinctive self. Our egocentricity is the expression of our embattled conscious thinking selves.

Do teachers have an obligation, in this age of specialisation, to impart a sense of unity and interdependency?

Many people think holism refers to the interdependency of systems. This is an evasion of its real meaning. Holism in the dictionary means the tendency in nature to form wholes. It's an acknowledgement of teleology – of the development of order of matter. Here we see a perfect example of our insecurity in the presence of the ideals – of the impasse of the human condition that I have been talking about.

Due to the law of negative entropy, matter integrates – it develops larger and more stable wholes. Atoms came together or integrated to form molecules, which in turn came together or integrated to form compounds. Compounds then integrated to form single-celled organisms which in turn integrated to form multicellular organisms. Societies of single

species followed then the integration of species with the final integration or harmony being of all things.

The essential ingredient of this development of order is that the individuals or parts consider the welfare of the group, or larger whole, above their own welfare. This is unconditional selflessness, the theme of integration, and surely what we mean by love.

The difficulty with accepting holism or the development of order of matter or integrative meaning is that it unjustly condemned us. As I have just explained, humans have, to a degree, had to be competitive, aggressive and selfish. We have not always been able to be ideal and co-operative, loving and selfless.

Science has made possible a clarifying explanation of our fundamental goodness. It reveals that while genes or instincts can orientate, only nerves can understand and therein is the reason for our upset state or condition. Science is the liberator, but it had to be evasive in its approach to the truth.

Science talked of evolution, which maintained that change was random not purposeful. Children in the future will not be taught evolution, instead they will be taught about the development or order of matter. The word development will replace the word evolution. Children will be taught that the meaning of life is to integrate, but at the same time it will be explained why, under the human condition, we were often unable to be integrative.

Is it possible to achieve a balanced existence which includes both faith and science, or are the two mutually exclusive?

This is the end of faith and belief and the beginning of knowing.

Holism and mechanism – religion and science are now reconciled, as are ideality and reality, the left and right wings in politics, good and evil and instinct and intellect, or conscience and conscious. We can safely resurrect our idealistic instinctive self or soul now. We no longer have to repress, because of ignorance of our true goodness. We are secure now. Guilt has gone.

The way forward now is back to our soul's world of happiness, naturalness, peace and sensitivity. The 21st century won't be a world of escapist high-tech plastic and glitter, as we are currently told, rather it will be a world of nature and fellowship; a world free of ego, aggression and alienation. The human condition has ended.

Will biology always separate men and women emotionally, or can some kind of genuine equality of understanding be achieved one day?



'Because women reproduced them, men couldn't destroy women as they did animals'

Before the emergence of the human condition, human society was matriarchal. The prime mover or main influence in human development at this stage was not tool-use or upright walking or language development, as we have been evasively taught, but the nurturing of infants. It was through nurturing that we acquired our soul, or instinctive training in love. Studies of primates are now revealing this truth.

Then, two million years ago, we became conscious animals, and the threat of ignorance appeared. Men, in their role as group protectors, went out to meet this threat, and human society became patriarchal, or male role dominated. Tragically, this battle made men angry, egocentric and alienated and they began to attack innocence for its implied criticism of their lack of innocence. Hunting animals wasn't to supply food as we have been taught: it was a way of attacking innocence.

Unable to explain their upset to women, women criticised men's upset, and so men also began to attack women. Because women reproduced them, men couldn't destroy women as they did the animals. Instead, they violated women's honour. Sex, which is an attack on the innocence of women, was invented. On a grander level, sex also became an act of love. When all the world disowned men for their unavoidable divisiveness, women stayed with them, bringing them the only warmth,

comfort and support they would know

Now that men can understand and explain their upset, it will subside, and the battle between the sexes will be resolved.

In the total scheme of life, how important is economics?

As it says in the song The Man of la Mancha "we had to march into Hell for a heavenly cause". To find knowledge, we had to suffer becoming upset. Self-corruption was the price of our heroic battle to champion the intellect. To compensate for this high price we were paying, we surround ourselves with

material rewards. Materialism was a poor substitute for spiritualism. Money is the medium of exchange for material wealth and economics is the management of money, ideally to achieve this necessary balance. With the need for power, glory and fame obsoleted with understanding of our greater goodness money and its management also become largely obsolete. Free of upset, we can self-control, and there will be no need for materialism.

Of course, the digestion of this understanding of our goodness and subsequent subsidence of our upset will take time. With the psychological key to the defence of our species found, the new world is now, at last, properly able to be born, but adjustment will take time. The main thing is that our species' horrible journey through the wilderness is finally over.

Jeremy Griffith is the author of the recently published *Beyond The Human Condition*.

Robots stay bottom of the class

Why can't machines think like humans? WILSON da SILVA talks to Marvin Minsky, the "father" of artificial intelligence.

PROFESSOR MARVIN MINSKY is quick to the point. The bespectacled and slight man, one of the founders of artificial intelligence, says today's computers already "think". But they have a serious problem – they lack common sense.

"You and I know you can pull a string but you can't push it," Minsky said in an interview. "Every child knows why, but I don't think there's a computer in the world that has a file on this. Find me a place in a book that explains that."

"Something that everybody knows won't be written anywhere. Why bother? But you need to describe it in detail for a computer to understand it."

Hence Minsky's first law – before we can arrive at a machine, be it a robot or an intelligent car, that can interact with us the way we interact with ourselves, a mammoth catalogue of simple, everyday things will have to be amassed. Without such a common-sense knowledge base, computer brains will never be able to fathom the human world.

"You can say that machines are thinking, they're just thinking dumb little thoughts," Minsky said, sipping a cup of coffee. "They're very precise and very fast, but they're limited thoughts."

"What we haven't been able to do is get them to do the things we think are easy. There's a good reason for that – when you do something that seems easy, like recognising an object, that's a big part of your brain that's highly evolved and works so well that it doesn't tell the rest of the brain how it's doing it. It's automatic, so it seems easy. But in fact, it's very hard to do."

Minsky is considered one of the fathers of artificial intelligence, or AI as proponents call it. He helped found the artificial intelligence laboratories at the Massachusetts Institute of Technology (MIT) in the United States, and through the 1950s and 1960s built an international reputation with pioneering work at the labs.

He rallied a generation of bright young students to his side, and established some of the basic steps toward creating artificial intelligence.

In the 1960s, his laboratory's Saint program, the world's first 'expert system', scored 96 per cent on a calculus exam drawn from previous MIT first-year finals. A former president of the American Association of Artificial Intelligence, Minsky helped make MIT a world centre for robotics with his early work on computer vision and manipulation.

Minsky says 30 years of AI research has taught scientists that intelligence is not one simple, all-emcompassing presence. It is most likely a co-operative association between a myriad of interacting thought tasks, controlled by a weak supervisory thought task we would probably recognise as consciousness.

"If you're holding a cup of coffee," he said, holding his china cup away from its saucer. "You don't want to have to think about whether the cup is tilting. What you do is, in the spinal column and the cerebellum, you set up little automatic sub-robots that keep measuring the pressure on your thumb and your finger, and if there's more pressure on your thumb, it sends a message back to your wrist to rotate and keep the cup level. And that doesn't bother the part of you that's talking or doing other things."

Similarly, some believe the brain "is 300 or 400 rather complicated computers in a big network. You can't do this sort of thinking by brute force. Thinking is too clever and tricky. But you can do it by 300 different approaches and somehow managing them to work together," he said.

'You can say that machines are thinking, they're just thinking dumb little thoughts'

To mirror human intelligence, researchers would have to divide thinking into hundreds of smaller tasks. This would be supervised by a controlling program, what we would call consciousness or intelligence in the human brain.

"It's the only good solution, working out ways of dividing the problem up, so you don't

have to have this one computer in the middle that knows everything. That would be too slow. And the controlling program doesn't have to be very smart. It just has to be there, and when there's a conflict, figure out which of the two parties [or thought tasks] should be turned off.

"Consciousness is very weak. Consciously you don't how you talk, or write, or see. People make a big fuss about consciousness, but it really doesn't do much. You only use it when other things fail.

Consciousness is a minor part of the thinking process, it will be very easy to put into machines.

"The hard part is, how do you retrieve the necessary facts to solve a problem. You know a million things – if the coffee isn't sweet enough," he said, motioning to his quickly emptying cup. "The answer is, 'put some sugar in it'.

Consciousness doesn't give you the idea of the sugar, it just notes there was a problem, and a quick search solved it.

Consciousness is very stupid. You don't know how to talk, you only can talk."

Minsky soon returned to the problem of imbuing machines with common sense, the sort of knowledge we humans take for granted.

"AI is waiting for these common-sense knowledge bases. I hope in about five years, some of them will become available. Otherwise, things will proceed very slowly. In my opinion, most applications are being held up by this."

"There are lots of applications designed for specific tasks that are proceeding. But the kind of machine that could talk to a person and help them with an everyday problem is still not on the horizon, because no machine knows all of the many meanings of ordinary spoken words."

"With a common-sense knowledge base, you could begin to solve everyday problems. You could make a robot that could clean the house and make the beds. You could make robot mechanics that could repair automobiles and fix torn clothing. There are so many things that people do [which can be done by machines],

and in the end, everything that people do."

He believes existing problems with making computers understand speech are surmountable: "There's a certain amount of development in natural language in computers, understanding everyday speech instead of mathematical language.

If.....you.....speak.....like.....this, there are already some low-cost machines that do a very good job. But if you speak continuously like this, there are some very big, slow



Marvin Minsky: To mirror human intelligence researchers would have to divide thinking into hundreds of smaller tasks.

machines that can do it, but they cost too much."

"But that's doomed until we get the common sense problems out of the way. With a common-sense knowledge base a machine could begin to solve everyday problems. If you can make a machine nearly as good as a person, then it should be easy to make it better than a person."

"The problem is, how do you get a machine to the level of a five-year-old child? If we get machines up to that then I don't think there are any limits," he said.

Early in the history of AI, some thought that the solution to giving computers intelligence was boosting their memory and processing power to dizzying levels, the so-called brute force approach. Others thought they could build machines that worked on pure logic, and would be able to reason through the application of pure computing power to a problem. But this was found to not work well.

Today, AI scientists are concentrating on breaking thought into separate tasks.

"I think some of the best things happening now are programs that allow

computers to learn. That would allow you to send robots to school to learn by themselves instead of being programmed. Send it to school or let it watch movies or read books – it's worked for us."

"There are some learning programs already in use. In chemical factories they monitor production and make small changes to improve product flow, and learn by experience. That's called an adaptive system. It learns rather quickly, and they're used all over industry."

"I saw an elevator-control program that learned by experience which floors were the most popular at different hours of the day. So if an elevator isn't in use – you know, in an old building usually an elevator ends up at the ground floor. But toward the end of the day, the best place for a smart elevator to be might be in the fifth floor of the building because the average time for the elevator to get to the 12th floor is shortest. It's very hard to figure this sort of thing out, but some of the adaptive-learning machines do a fine job. An if conditions change in a few days, you don't have to call up the factory to re-program the elevator."

Some big money is being spent on AI. At the International Joint Conference on Artificial Intelligence in August, 1500 researchers from 31 countries met at the Sydney Convention Centre for six days.

Despite Minsky's optimism, there are still problems for the world's artificial intelligence experts. Delegates detailed studies into some of the remaining stumbling blocks – how to make computers learn from experience, apply their knowledge to new situations and be able to see and recognise the world around them.

Of them all, which is the next frontier for AI?

"Reasoning by analogy instead of by logic," Minsky said.

"The way humans solve things is, you have a problem, you can't solve it but you say 'Well, this reminds me of another problem that I did solve'. Last time you had to change a light bulb, but last time there was a ladder. But there's no ladder this time. 'Last time I wanted to reach something high, though, I stood on a chair' – it's that sort of thing, people do this all the time."

Wilson da Silva is a Sydney-based foreign correspondent for the International Reuters News Service.



The eve of reconstruction

The biggest conference on the environment yet will be held next year. JOHN TILEMANN reports.

The United Nations has, through its history, chased many elusory goals – perhaps the inevitable fate of any organisation with vision and ambition. With the impending Earth Summit in Rio de Janeiro in 1992 tackling the twin challenges of environment and development, the UN is facing one of the most complex and comprehensive tasks ever undertaken on a global level.

The Norwegian Prime Minister, Gro Harlem Brundtland, taking on the chair of the World Commission on Environment and Development, accepted "the challenge of facing the future, and of safeguarding the interests of coming generations". The commission's report, *Our Common Future*, presented to

the UN General Assembly in 1987, contained major challenges for advocates of development and confirmed public fears of the degradation of the global environment. The result was a pragmatic call for sustainable development.

In his introduction to the Australian edition of *Our Common Future*, Prime Minister Bob Hawke stated that "although the concept of ecologically sustainable development, as formulated in *Our Common Future*, has meant different things to different people, there has been a recognition that we must plan for more than our own future; we must also plan for that of our children and of generations yet to be born".

The Road to Rio

The Brundtland Report was debated by the UN in 1989 with a resolution to hold a global summit in Rio de Janeiro in June 1992. Dubbed the Earth Summit, the United Nations Conference on

Environment and Development – UNCED – may well be the biggest gathering of national leaders ever held. The Australian Prime Minister announced at the November Commonwealth Heads of Government meeting that he would be attending the conference.

Preparations are well underway; three planning meetings have been held with the final gathering in New York in March 1992. The agenda tackles the complex and challenging questions facing this and future generations: poverty and population, city development and land degradation, management of the oceans, the atmosphere and the threat of extinction of species. Two of the most pressing issues – climate change and the protection of biological diversity – are the subject of parallel negotiations aimed at having global Framework Conventions prepared for signature at the Heads of Government gathering at the Rio Summit.

The road has not been all easy. Whaling nations want to preserve the option to continue whaling. Those nations which export toxic wastes are concerned that this possibility might be closed to them. The process could also add to the pressures to lower agricultural protection; to relieve debt and to increase aid flows. These demands present major challenges to some developed countries. The Malaysian Prime Minister, Dr Mahathir, has suggested that Malaysia would withdraw from UNCED, arguing that the preparatory process has not given sufficient attention to the concerns of developing countries.

Australia's Ambassador for the Environment, Sir Ninian Stephen, is leading the Australian delegation to the UNCED preparatory process, including diplomats, environmental experts, representatives of State Governments, industry, business and environmental organisations.

quality of life, however current patterns of development continue to destroy this precious resource. Much has been achieved in reversing the pattern of unthinking destruction of natural habitats. Efforts to balance the needs of development with those of conservation of our biological inheritance are now a feature of the policies and politics of many countries.

Negotiations continue with a major issue being how developing countries can be assisted to conserve their stocks of biological diversity while meeting the demands of increasing population and improved standards of living.

The Earth Summit

UNCED will not attempt to solve all the problems. Rather, it can allow world leaders to reaffirm a commitment to the needs of the world in a way that preserves the prospects of future generations. It is expected to adopt a declaration – the Rio Declaration, or Earth Charter – establishing principles to be observed by nations if the aim of sustainable development is to be achieved.

The conference will also produce a plan of action entitled Agenda 21. This will include commitments to sustainable development principles and mechanisms to assist developing countries to adopt more environmentally sensitive development paths. Australia has already undertaken to provide \$80 million over four years under its expanded Environment Assistance Program.

The challenge is now directly aimed at business and industry – new developments present a threat to some, but create opportunities for the imaginative. New technologies and the improved management of resources. For the imaginative, with expertise and management skills, there is much to gain.

The Australian edition of Our Common Future, was published by the Australian Commission For The Future and Oxford University Press in 1990. Copies are available from the ACFF. Enquires should be made to Jenny Martyn; Publications Manager; (03) 663 3281.

John Tilemann is the director of the Environment Section, Department of Foreign Affairs and Trade.

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A change in climate

The issue of man-made changes to climate has been the subject of extensive international scientific investigation. There is little dispute that the threat is a real one; the world community has accepted that the risks are sufficiently great to warrant urgent effort to limit man-made changes to climate patterns.

The negotiations go to the heart of national concerns over development goals and strategies, patterns of production and consumption, the right to economic progress and social well-being. Australia's major role will be in adopting the established targets. Australia has a critical stake, not least because of its status as a major consumer and producer of fossil fuels. However, many countries see little hope of breaking the cycle of poverty without massive increase in energy consumption for development – most notably in regions such as South and East Asia. For many countries, there is simply no immediately available alternative to the increased use of fossil fuels.

The price of All Things Bright And Beautiful

Biological diversity contributes to science, development and the

Why all the world's a stage

Years ago, Barry Humphries wrote and performed a piece called *A Nice Night's Entertainment*. It told of dinner and a show at the local RSL, and it was a real find. Many of us still hunt that sort of evening just what the doctor ordered, even today. For others, there must be more.

Entertainment depends very much on where you are, and when. Earlier this year in China, the Shanghai acrobats were my choice, but because I was on my way to Europe I looked forward to lots of Mozart and Strauss in various forms. Then in Ireland there would be eating and dance, the way it's been for many a day.

The sights and sounds of every day are what really provide us with entertainment at home and abroad, and my recent study tour of Europe revealed all sorts of popular entertainment. So-called tourist attractions often were attended in huge numbers by local citizens hungering after a laugh at themselves, or a burst of patriotic song.

The beer-halls in Germany, the wine-cellar in Austria, the castle banquets in Ireland, boat rides in France, pasta palaces in Italy and the sweetmeats of Switzerland certainly did not disappoint in this regard. A great deal of

assessment goes on with conducted tours – of the program, the guides, the leaders and, little do they realise, of the participants too by those same guides and tour leaders. On a scale of one to 10, no-one seems to exceed 8 ½. All too many gain only three or four points.

So it is with entertainments. Of course, I'm still talking as a tourist. As such, participation theatre, even of the simplest kind, must have a future.

Look at Paris: dinner on the Bateaux Mouches is a real experience of the place, the people and the food. Forget the other tourists. We were on a wonderful merry-go-round created especially for us. I'd previously thought it one of those treats for them.

Then there was the Waltz and Operetta Concert in Vienna. I've been to the Opera and the Volksoper many times, at great cost, also to the summer Strauss dances outside the Kursalon. But this was in the vast Konzerthaus, built for the purpose right behind the much-revered Imperial Hotel, and all for \$35, any seat in the house. It's now top of the pops for me.

The trouble with travelling is that there is little time for reading and less for writing, while we look for things to

do. Not at all difficult overseas, but less easy here. However, mostly there's an awful sameness – in the films travellers can see at home, or an expensive range of plays, ballets and operas in the state theatres.

A musician I met in Vienna deplored the fact that nowadays all over the world people can hear the same performers and conductors on disc, if not in person, and accused record companies of seeking the best technical

people rather than great musicians and singers.

I think he protests too much. It's absolute heaven for the stay-at-home to have such superb music readily and inexpensively available: a solution not easily found in the theatres, which everyone complains are pricing themselves out of business.

At the same time, in Australia there are opportunities to sample the Aussie way of life: enjoy a country property for a day or a week, join a pub singalong or bound along a beach. We may cringe a little, but the visitors love it.

Wider choices have become available in Asia, and it will be difficult not to put some of the older sorts of

theatre on the backburner, since we can't have everything at the same time. Or can we?

Preference and demands also change as we become older and wiser. The rock specialist becomes a chamber music addict, the sailor years for some jazz, there's a lot of moving sideways.

My dictionary defines PORCUPINE as any of the various European, American and Asian rodents covered with long protective spines. Have a look at a porcupine – well, a picture of one – and imagine each of its spines standing for a different sort of entertainment, different lengths but all going in the same direction.

In fact as I try to put this piece together my own plan has changed. I'm in a place between Delhi and Bangkok, and my section of the plane had lost all electrical power. I have no light, no sound and no hope, and am assured that there will be nothing but a little cabin light as we land.

Add to that the fact that my proper notes are in the hold and you've got a real stew, with few of the fine flavours promised. Have I given any thought to the blind and deaf? Not until now, when I too cannot read . . . a basic right, a basic entertainment.

Margaret Whitlam, a professional social worker, is president of the Commonwealth Association for the Education and Training of Adults



MARGARET WHITLAM



WHAT'S NEW

Petit parkers in Paris

> **THE CAR IN EUROPE.** Paris is perhaps a parking bay or two ahead in the search for the perfect small city car. The *voiturette sans permis* (without licence) is a tiny two-cylinder diesel which as yet has no registration. Because ownership cannot be traced, *voiturettes* can be parked almost anywhere in half the usual space. And they are enormously popular with drivers who have problems passing the test for larger vehicles, or have been disqualified. However the parking officers, never far behind anywhere, plan to have the loopholes closed by March 1992. Sales of the *voiturette* are expected to slump.

THE CHRISTIAN SCIENCE MONITOR

> **THE CAR IN AMERICA.** First came the Swatch watch. Next? Perhaps the Swatchmobile. Nicolas Hayek, who saved the Swiss watch industry from Japanese competition, is developing an electric car with Volkswagen to carry "two people and two cases of beer". It will sell for \$US6000 and Hayek says: "It's got to be a real car, not

one of those toy electric things they have now." The man who saved an empire with brash marketing and innovation added: "What makes me tick is not some craziness with junk bonds and dismantling companies. You can't get me into those deals. But to start something new, to build something, to change something – I'm available. It would be a pleasure to contribute something good, something that will fight against the decadence of this civilisation." Results are expected to be on the road in the US by 1994.

THE WASHINGTON POST

> **THE CAR IN JAPAN.** When is a car not a car? When it's a work of art. Japanese designers at Nissan have shown a surprising creative streak with limited editions of vehicles notable for their unusual looks. Produced in limited editions as small as 10,000 units, the BE-1, PAO, Figaro and S-Cargo have delighted those Japanese motorists with a low tolerance to mass-produced models.

There are 36 design teams (average age 28) involved in "the process of mental liberation." Such is their dedication that one team spent a week combing the bars and boutiques of Tokyo's trendy Roppongi district in search of new social trends.

FOCUS JAPAN



The S-Cargo: a joke on wheels.

> **The engaged signal may become a thing of the past if voice mailboxes prove popular.** Regional telephone companies in the US are offering a new service where incoming calls are picked up if a telephone is busy or not answered. Messages can be left in as many as eight

mailboxes for individual members of the family. While the service is cheaper than private telephone answering services, it is dearer and more difficult to operate than an answering machine. About 100,000 homes are using home voice mail in San Francisco and Los Angeles.

NEW YORK TIMES

> **Tame that tan.** A new wristwatch developed by Kanebo measures the intensity of ultraviolet radiation so that sunbathers

> **Hikers and other rugged individualists can now carry their electric power with them on their backs.** A portable solar power system called Chargeabout produces power even when less than 10 per cent of midday sun is available. The device could benefit scientific expeditions in the mountains or deserts, where electricity is needed to power film, recording, and communications equipment in arduous climatic conditions. Chargeabout was developed by Solabak Limited of Britain.

THE FUTURIST

> **Don't drink the water in strange places.** At least, not unless you have the new portable purifier that filters water and kills bacteria and viruses. The choice between systems to remove Giardia cysts, which cause intestinal disorders, and iodine tablets to treat for bacteria and viruses, is no longer necessary. The device passes water through a microfilter that traps small cysts and suspended solids, and it also contains a disinfectant made of iodine and ammonium anion that kills viruses and bacteria on contact. The PUR Traveler, by Recovery Engineering, is compact, speedy and priced at \$US49.95.

NEW TECHNOLOGY JAPAN

NEW YORK TIMES

TRIPLE J DID NOT DISCOVER ABBA.



We also can claim no responsibility for Kylie Minogue's success. Or Julio Iglesias's. But pretty well every other major new act in the last 16 years, from INXS and Midnight Oil through to Ratcat, got its start in this country with us.

Over 850,000 (and rising) listeners tune in every week to be challenged by our fresh daily mix of pop, rock, house, heavy metal, thrash, blues, dance, independent, rap, country and western, and of course, Gregorian chant.

We're young, informative and in touch. And we're not afraid to stir the possum occasionally.

Taking chances comes naturally to us.

That's why if it's new, you'll hear it first on TRIPLE J. Okay, so we didn't discover Abba. But if another Abba comes along, we'll be the first to give them a run. While they're still fresh.

T H E F U T U R I S T S

F U T U

F R O N

If, as L.P. Hartley wrote, the past is a foreign country, then the future is a bright new continent waiting to be explored. In this special report, we profile seven individuals whose lives have already been altered by the future. They are the pathfinders, the first explorers of the bright new continent, and some call them futurists. Their aim is not to predict events, but to show us how to interpret the signs, to make better decisions and to explore our own tantalising horizons.

L I N E

A SPECIAL 21•C REPORT

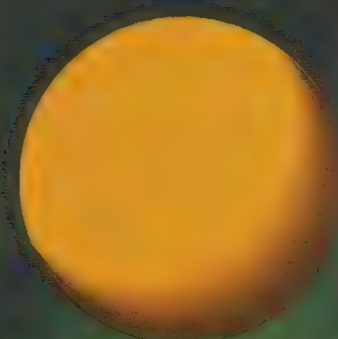
PROFILES BY CLARE DENHARDT IN EUROPE AND ASHLEY CRAWFORD IN AUSTRALIA.

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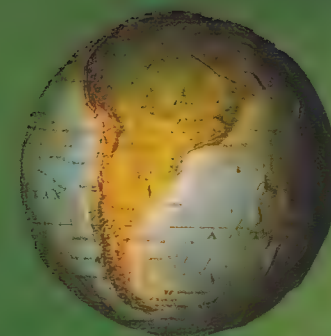
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HORIZONS

SPEAKING FUTURISTICALLY, OPTIMISTICALLY

BY SUSAN OLIVER

Time and again literature, newspapers and social surveys highlight our society's inability to imagine a happy future. Australia's weekly news magazine *The Bulletin* recently reported the results of market research which gave the average Australian's vision of the year 2000 as "bleak and gloomy and characterised by high-rise buildings, treeless concrete, pollution, sadness and danger".

A survey late last year by the *Sydney Morning Herald* of 11-year-old Sydney school children shocked the researchers into saying: "But nothing prepared us for the depth of the children's fear of the future, their despair about the state of our planet and their bleak predictions for their own nation, Australia".

This despair hangs heavily. What can one say? What can one do? Certainly world population pressures, increasing numbers of refugees, desertification of previously arable lands, soil, water and air degradation from a variety of causes are reasons for great global despair. But these are probably inevitably the outcomes of the present social paradigm described by Kirk McNulty of Applied Futures in Britain as the "industrial paradigm", a "pragmatic, materialistic society in which the purpose of human endeavours is the satisfaction of physical needs". I would add the adjectives "immediate", "personal" and "greedy". So this paradigm does not seem to meet the needs of the world's populations with a great deal of equity and justice, nor has it resulted in well-managed environments, resources and social systems. And it is apparently deeply perturbing to Australians as a basis for projecting the future.

I've sworn before that I wouldn't argue for a "paradigm shift" because it seems so overworked, tired and "academic". Yet it is a paradigm shift that we should now be working to achieve. Events in the Soviet Union in recent months have illustrated that such a shift does occur, and with stunning speed and scope.

The German humanist-philosopher Robert Jungk who initiated the first International Future Research Conference (Oslo) and co-founded Mankind 2000 (both in 1967), wrote in 1973 that "we have to find new ways, new methods of changing history" and gave the following reason for becoming a futurist.

"And I'll never forget how these victims, and especially an elderly couple, who were about to die from the long-range consequences of the (Hiroshima) bomb, asked me, who came from abroad: 'Didn't the people who threw that bomb think about these long-term consequences? Didn't they know that this was not an ordinary weapon, but a weapon which reached out into time - which destroyed not only space, but also the time ahead of it?' And I said: 'No, they did not think enough about it.'"

"I once wrote a story of the family of atomic scientists, and again and again, I was surprised by the lack of foresight of those whose job is really foresight. C.P. Snow has said that scientists have the future in their bones; but I must say most of these scientists didn't have the future in theirs. They really did not give attention soon enough to what might happen, what might be the consequences of their efforts; they just did their thing. They were what we now call in German *fachidioten*, overspecialised idiots, primarily after a more perfect, a more beautiful gadget. And when they finally began to have afterthoughts, it was already too late. The gadgets were no longer theirs, they belonged to the people who had paid for their efforts.

"Now, why have I become a futurist? Because I feel that this kind of attitude is actually leading us into disaster. I was tired of being the eternal victim; I was tired, like many progressive people, of running behind that cruel train of historical events, of crying out against the injustices done in the world after they had been committed. I said to myself, why can't we actually anticipate developments so that these catastrophes don't happen any more? Isn't there a way to foresee where we are going? Isn't there a way to avoid unnecessary catastrophes and isn't there a way to induce change in a more modern and better way than by barricades, revolutions, fire, arson, and war? Sure, this has been the way changes came about for ages and ages, and again and again, but I think we have come to a point in history where we can't change that way any more. We have to find new ways, new methods of changing history. And that's when I changed from a reporter into an activist, and also turned to something we now call futures research." A belief in the principles of futures research is fundamental to the role of Australia's Commission for the Future. Michel Godet, the French futurist featured in this issue of 21•C describes three attitudes to the future best translated as passive, reactive and proactive.

He writes: "The passive attitude to the future is a legacy of religious fatalism", the reactive attitude "has not purged the original sin of determinism and inevitability, but curiously fatalism has cast-off its religious habits to assume the mantle of a new idol - science and technology. The passive wait-and-see attitude has been transmitted into blind faith in the unlimited powers of a technological good fairy, who will solve all problems, including those for which she is responsible". The antithesis of this is the technological pessimism experienced by our young people and the average Australians of the study I've mentioned above.

Godet goes on to say: "An antifatalistic attitude is essential. People are not fated to accept relationships which are necessary, determined and outside their control. They also create relationships by their will and by their actions."

This is a critical point to ponder and presents a turning point for the would-be optimist among the average Australians and our youth. Become a futurist! Futures research begins by understanding that several futures are possible but the one that we desire remains to be made by us.

Susan Oliver is the Managing Director of the Australian Commission For The Future Ltd

If we are going to have a different kind of world from what we've had in the past we will need to go through a chaotic period, and that seems to be happening right now.

BY MARTHA GARRETT

Whenever she takes a plane, Martha Garrett faces a definitional problem: what to put in the "profession" box on the disembarkation card. "I have no idea what to call myself. I find this an exciting sign of our times – change has happened so fast that our language doesn't keep up with reality. There are jobs that didn't exist 10 years ago and so we have no word to describe them. My job involves so many activities – teaching, fund-raising, administering, writing, editing, being an ecologist . . ."

Her official title is European representative of the Institute for 21st Century Studies, an independent, non-profit, US-based organisation with which she has been working for five years. "This means I sit in the basement of my house in Sweden, with several mountains of manuscripts on the floor and lots of telecommunications equipment." It also means she works with 21st century study groups all over the world, in face-to-face training sessions, acting as a catalyst to get studies going and helping teams to find both funding and the tools they need in their work.

What exactly is a 21st century study? "It is a serious analysis of long-term alternatives for a nation or a region, with a number of specific characteristics: it is multisectoral, stressing the connections between sectors; it takes a longer-term look than the standard five-year national plan; it is aimed at finding sustainable strategies, in terms of both environment and social justice, and it seeks to provide opportunities for people to participate in democratic choices about their future. Ideally it should involve a good cross-section of the population, with both policy makers and the public participating in the debate, not only once the study has been completed but also as a part of the study itself."

There are perhaps 75 teams in the world calling themselves national 21st century study teams, but probably only half are doing studies that are multi-disciplinary. Many teams look solely at economics, which Garrett feels is inappropriate when considering the future of a nation. To do this you need a multiple perspective, which means you cannot fight shy of ethical and religious issues, often involving politically sensitive topics such as the treatment of minorities or drug trafficking: "When you are talking about the future of a nation you have people, and where you have people you have values. Many people feel comfortable doing econometric projections or building competent models, but questions of what it is to be a human being on this Earth

and what the important values of our cultures are make them very uneasy."

Carrying out a 21st century study can be a dangerous and controversial activity. A team in El Salvador was pinned to the floor to avoid the bullets flying through the office window; in Colombia the team has had to go into hiding because of its criticism of the country's drug barons.

So what motivates these teams? First, they want to stimulate awareness of the future, talking and thinking about it, in the hope of switching the focus of a whole society towards the long term. Second, although many teams will say they're only trying to point out alternatives, all have some underlying desire to change the future and make it better. But it's a vast undertaking, as Garrett points out: "If you think about arguing with just one human being to try to change their perspective on a single issue, then you realise the enormity of trying to change the perspective of a nation."

This does not mean that building the future cannot start at the level of daily life in the community. One team, constructing highly sophisticated computer models of the future of El Salvador, is also helping grassroots groups to change their own futures in very practical ways – they are teaching handicapped people to build wheelchairs showing women how to cook soya beans and increase the protein content of their diet, and setting up community composting schemes to reduce garbage and improve soil fertility. Garrett believes that increasingly, people may start to take the future into their own hands through local community groups. She senses the beginnings of a realisation that "those who ignore the future are condemned not to have a say in it – it can't be left just to academics, economists, politicians and corporations; there are lots of different ways and channels through which we can all affect the way the future will be."

To be a competent futurist, Garrett feels that three things are essential: to be able to think long-term and imagine things that we may never experience ourselves; to think in a systems way, spotting the connections and feedbacks between different phenomena; and to have a global perspective – not just seeing things in terms of one country or one culture. "I remember clearly the moment that I gained this global perspective. I was 19, and stepping out of a plane in Accra, Ghana, where I had gone to collect snakes for my biology



studies. I saw Africa spread out before me and it changed my life. I think all futurists should at least spend a vacation in a developing country. For most people in the industrialised world it is very difficult to imagine what it is like to live in a really poor Third World country. So although it would be a satisfying experience to help make the world a better place, most people can't experience it directly – if they vote in a government that will levy higher taxes to relieve Third World debt, they have no personal feedback, and cannot see the impacts which such a policy might have."

A crucial part of a successful 21st century study is therefore the way it is interpreted to the public. Without well thought out and appealing efforts at public dissemination, a study will merely gather dust. A model example is a team in Czechoslovakia that has barely started work on the study, but which at this early stage is already planning slide shows for schools, symposia for policy makers and videos for public presentation.

Again and again, in 21st century studies from all countries, the same major threats for the future emerge: the environmental problems resulting from pressure on our life support system; the continuing threat of nuclear war despite changes in the balance of power; and growing tensions because of differences between the lives and goals of industrialised and developing countries related to such problems as Third World debt.

In the face of these, Garrett describes herself as "pessimistic but not without hope (to quote Herman Daly)". If we are to survive the next 50 years, she says, we need to learn two important lessons – how to live in harmony with nature, and how to live in harmony with each other. "Maybe the loosening up of situations around the world that we are witnessing today is the first step towards something better. If we are going to have a different kind of world from what we've had in the past we will need to go through a chaotic period, and that seems to be happening right now."

Unemployment is a major problem for the West, as is the issue of its declining birthrates. A society where the birthrate is not replacing the population is a society that has lost its belief in the future. It's a kind of suicide.

MICHEL GODET



Michel Godet describes himself as a "conspirator of the future". He believes that thinking about the future should not be confined to specialists: "Everyone is concerned with the future – it is not a science, it's an attitude, and you need this attitude to give sense to your present action. My role is increasingly to spread the virus of futures thinking, not for the satisfaction of predicting what will happen, but to give both meaning and direction to present action." This difference is crystalised in the Confucian saying: 'Don't give the people fish; teach them how to fish.'


Godet is professor of industrial prospective at the National Conservatory of Arts and Professions in Paris. For him, the difference between the French concept of "prospective" and the American term "futurology" is all important. "In futurology the assumption is that most of the future is or could be predictable. Futurology is considered a science of the future in the same way that history is a science of the past. For historians and futurologists, the only uncertainties lie in the interpretation. But for prospectivists the future will never be pre-

dictable, for it has yet to be constructed. It depends on our will and our desires. Prospective involves more than merely preparing ourselves for change imposed by some immutable future law. The main core of the prospective attitude is to be not only preactive, preparing for unforeseen change, but also proactive, provoking desire for change. Interpreting and creating the future are not the same thing."

Godet's career began 20 years ago. Having studied econometrics and modelling, he started to work for the French Atomic Energy Commission. There he discovered that it was not possible to predict the price of oil by modelling supply and demand curves. The main role was played by the balance of power and the strategies of actors in the field. So he developed a new approach which could take account of these factors, by combining systems analysis and the scenario method.

Four kinds of questions are fundamental to any prospective exercise: What are the key variables and uncertainties for the future? Who are the main actors behind these variables? What are your own goals

In Colombia the team has had to go into hiding because of its criticism of t



as an actor? What are the future scenarios in which you must develop your strategies. Scenarios must fulfil four conditions – they must be relevant, consistent, likely and appropriable by the people concerned. Despite the ever-increasing complexity of today's world, Godet insists that simple tools are the only way to deal with complicated problems. "Try thinking about the future – it's easy. You'll soon become an advanced prospectivist yourself. Thinking about another future changes your present – it changes your life."

Godet no longer believes in the effectiveness of big national plans, or official reports about the future. Most of the time, the key issues are omitted for political reasons, he says. "What is new is the discovery that the future depends mainly on what we would like to become, at every level. The events in Eastern Europe would have been unthinkable four years ago, except as a dream of the people there. Dreams create reality."

He does, however, see a renaissance of planning at the local level – the main difference between individual firms and cities today is whether they have goals for the future, he says. Most of his work now involves running seminars and workshops with local projects – infecting companies and municipalities with the futures virus "to an extent I show people how to be futurists themselves."

He is particularly pleased with a recent project he organised with the inhabitants of the French town, Vierzon. In 1990, after 30 years with a communist town council, Vierzon was in decline; the population was moving out, companies were closing down, there were record levels of strikes and unemployment. At the request of a newly elected town council, Godet set about helping the inhabitants to change their future. For two days, about 80 local people (councillors, unionists, industrialists, business people and teachers) took part in Godet's prospective workshops, thinking about the future of their town and putting together some proposals. They then presented the ideas and suggestions emerging from their workshops to the community. "And so a process of collective mobilisation in search of a better future was underway. For a whole year, the people were running workshops street by street, and afterwards they told me everything had changed. Previously Vierzon was resigned to its

decline. Now it realises it is master of its own destiny."

"One of my struggles is to find an equilibrium between reason and passion," says Godet. "For effective prospective action we need rationality – the use of appropriate tools and techniques – and also passion, motivation and enthusiasm." It is also essential to question conventional wisdom.

Learning how to do this forms a significant part of Godet's workshops. "Everyone acts as a censor of themselves. Most of the time, reality is in advance of fiction. I'm surprised, every day. People's minds are changing rapidly and things which were impossible a few months ago are already here – look at what's happening in the Soviet Union. So we have to ask ourselves what we consider impossible, why, and whether we're not just thinking rigidly. The rigidities are in our minds, and prospective is about opening windows in the mind."

Godet thinks the future will be turbulent because of demographic trends. There will be mass emigration from Africa and from Eastern Europe, and frontiers will explode while the Western World watches its birthrates decline and its population age. The new world order that Bush describes is not here yet, he says. But he is optimistic for the long term. "In 1967 I was not yet 20 years old, and at that time the map of democracy throughout the world was shrinking in Greece, in Spain, in South America. Now the situation is the opposite, democracy is spreading, and this has happened in such a short time."

There is no room for complacency on the part of the West, however. "Just because our democratic model is developing in other countries does not mean it is perfect. We need to improve it greatly. Unemployment is a major problem for the West, as is the issue of its declining birthrates. A society where the birthrate is not replacing the population is a society that has lost its belief in the future. It's a kind of suicide."


"What is missing today is a collective goal and desire for the future," says Godet. "I am working to create new hope for the future, a key factor that could change a lot of other factors."



THE FUTURISTS

People used to think the technological revolution was something to do with automation, that there would be factories with nobody there, and people would end up pushing buttons. What we're seeing in fact is an increasing demand for skill but different sorts of skill.

JAMES RUSCOE

 James Ruscoe epitomises Renaissance man; well dressed, speaking Oxford English and sporting a tan acquired in Indonesia, Ruscoe exudes the style of his native Italy and an urbane confidence. Beyond the surface, Ruscoe's credentials more than prove an extraordinary ability to utilise his speciality, the future, across a broad range. James Ruscoe is adviser to the chairman of Italy's leading commercial bank, the Istituto Bancario San Paoli Di Torini, on international issues relating to science, technology and the arts. He is scientific adviser to the Fondazione San Paoli di Torino, Italy's largest non-profit foundation, and adviser to the chairman of the Italian Commission for Nuclear and Alternative Energy Sources (ENEA) on issues pertaining to energy, the environment and economic development, on international policy and on the socio-economic impact of technology. He is also adviser to the Heads of the Nuclear Directorates of ENEA on international energy policies and strategies. For all his credentials, Ruscoe is warm, friendly and funny: he says thongs, or "flip-flops" as he calls them, are one of Australia's more dubious contributions to world culture.

Ruscoe defines his futures work in terms of strategy. "You have to define futures in terms of: Why do we think about the future?" he says. "If you look in the past, you go through history or literature, people have always believed they've lived in periods of transition. We're not unique in that. What we can say is that things are changing faster now than they have done for 200 years. We're at a moment comparable only to the 1780s, 1830s – I don't wish to be too historical about it, but we're talking about the Industrial Revolution; steam power, or electrification at the beginning of this century.

This scenario, says Ruscoe, makes it "necessary to prepare ourselves for what could potentially happen. Therefore futures is not prediction, nor is it forecasting – it's essentially an attempt to assess, to monitor, to pick up signals, and work out what might happen, to see what sort of reaction a country, a nation, a town, an industry, a firm, might have to take in order to face challenges which at the moment may be only a dot on the horizon, but which could loom very, very quickly."

Ruscoe is enthusiastic about Australia's position in terms of its potential technology and economics and dismisses the tyranny of distance fears with a flick of a hand. "Australia could well be the centre of the technological universe, because the globalisation of the economy and of society is going on so fast that geographical proximity isn't necessarily the problem. But cultural proximity does matter. And that is where

Australia may find itself excluded if it doesn't maintain, as I say, monitoring, assessment antennae. It is very, very important that a nation, a country, a firm, or industry, picks up messages and vets the information and looks outwards, and it's very important that someone interprets them in whatever way is regarded as necessary by that society, so that things don't come as a surprise. Because there are going to be a lot of very big surprises, and it's unfortunate if a country like Australia, which has always been, to me, a synonym of a country of promise, suddenly found itself relegated to being a backwater.

"We shouldn't overlook the speed with which this can happen. Let's get back to our example of the 1780s. In 1780, what was the world's greatest power? Well, it certainly wasn't Britain – it had just been depleted in a war. It was France. France, Versailles – that's where, in 1783, the treaty that created the United States was signed. The French, to all intents and purposes, were in a very strong position. It wasn't the revolution that stopped that, it was British steam power. France suddenly became a secondary player. France has only since the Second World War come back to being a major European industrial power.

"You say, well, this is history. It's not just history. Why is it we now talk about living in a single-power world? Up until two, three years ago, there were two great powers. What's happened to the other one? It's suddenly become apparent that the USSR is light years behind the US in technology. You're talking about a country which now is even considering whether it will exist through this decade. And why? Because technology has changed. The pace of change is such that it can happen to big countries like the USSR. It can happen to a country like Australia."

Australia, with its tradition of commodities – mining and harvesting – can currently be seen as being disaffected by the growth of technology and manufacturing as the greatest internationally traded goods and services. Ruscoe sounds regretful when he states that the role of Australia in the global economy will inevitably shrink. "Australia as a resource producer has to face the fact that natural resources matter less and less and less. The value of natural resources is declining in real terms and will continue to decline, as technology and know-how and science, which is embedded in products and services, assumes the dominant role in determining price. Then if all you do is produce the steel for the box, then that's not going to be enough to guarantee you any sort of say in determining that price or in receiving it at the end of the day.

One of the great problems of Australia is that it has two great



On Australia's future: There

national resources, one of which it's concentrated on, and one of which it seems to have underestimated. The first is that it's overestimated its resource base. Now, Nigeria's got a vast resource base – immense wealth – but that's not going to solve Nigeria's problems. You've got very, very rich natural resource companies. I think they'd be very wise to start thinking seriously about diversifying. The other resource which I think you have underestimated is the people here. I'm not sure whether the education system, the training system, the human resource base in Australia, has been sufficiently exploited. You don't have the numbers, so you're not a market. If you think in terms of the three great players – Japan, the U S and Europe – Europe fails in all sorts of tests. We're not the brightest, we're not the most technologically advanced, we're not this, we're not that. What we do have is that we have 320 million rich consumers. And that guarantees us a place at the table. Unfortunately, you don't have that. But you do have a remarkable number of bright and young people who need to be pepped up. But I think the amount of money you're going to have to invest in human resources in this country is going to be quite, quite significant – as much as in Europe."

Ruscoe believes that, as a futurist, the advice to the Australian companies which have made their wealth from natural resources would be diversification. "Not necessarily even vertical diversification. In the Australia context, given the distance and lack of market, you're going to have to find a new way to diversify. It's going to be an Australia solution, I think, to an Australia problem."

As an adviser to one of Italy's leading banks Ruscoe sees the future of financial investment from Europe in Australia as static, if not declining due to the preoccupation with Eastern Europe. "My bank is Italy's largest bank and the most international bank. We're based in Turin; we are the largest non-national retail bank in France and in Spain and now in Hungary, and we're expanding into Czechoslovakia and the Soviet Union. We may buy a bank in the Baltic. These are home patch for us now. I think there's going to be a lot of money to be made, in the long term, in these countries."

Given the economic consolidation of the Americans and Europe, Ruscoe sees Australia's only option as economic integration with Asia via ASEAN. "ASEAN is consolidating on an economic level and attempting to emulate the EEC. They are no longer solely interested in trade. I'm inviting ASEAN experts to my next conference, which is on the transfer of environmentally benign technologies into Eastern Europe and the Third World, and the

business opportunities arising from those. They receive but they also manufacture and export, so they are very significant players and they now wish to take a direct role – no longer as individual member states but as a unit.

"Now, will Australia participate in Asia? Well, to participate in Asia it has to participate first in ASEAN, because that's your bridge. You can, if you wish to, play the Singapore role, and just be a continent-sized city state. But the major resource then would be the human resource. One of Australia's resources is that so many different ethnic groups are represented here. If there's going to be business opportunities in the Ukraine or in Poland or in Lithuania, I hope that ethnic Lithuanians and Poles, living in Australia now for two generations, are going to participate because that's where you can build up links and contacts. There's no need to homogenise Australia. Australia is a melting pot, and you should capitalise on that."

Ruscoe is also not necessarily convinced that Australia's comparatively small population is a major economic stumbling block. "You have a significant Vietnamese community here and Vietnam is, without doubt, the biggest business opportunity in Asia at the moment. Indonesia is a major player. Japan, of course, is a major player. Korea. Why isn't Australia? Why shouldn't Australia take part and be a major player?"

"One thinks of Australia as being 'out here' because it is such a



need to homogenise Australia. Australia is a melting pot, and you should capitalise on that.

long way away. But there are other places which are as far away and which have turned round – look at Chile, the economic miracle in Chile is real. It isn't hype, it isn't an attempt to whitewash Pinochet. He actually did turn round a classic South American tin-pot republic into a major economic force."

In Europe or the Americas the field of futures is rapidly developing, and as a futurist Ruscoe advises within the wide brief of science, technology and the arts. "It isn't a 'career' in any easy sort of way," he says. "You can't go to a business school and come out with a futures qualification. But nor necessarily should you. What we're seeing in the current phase of this technological revolution is a change in the skill demands of the whole world economy."

"There is an increasing need for people who can understand and appreciate a problem and express it better, because communications skills are what is becoming most important. And that's what futurists, I think, are. What we have to do is to communicate to decision-makers above all, but also opinion-formers and ordinary people. Kids, above all, kids. They're the ones who are to make the biggest decision – which job to take, which career to follow. We're the ones who have to be able to communicate what we see as happening, with sufficient clarity and conviction. For that you need to be a generalist. I'm not a scientist – I'm an economist by training – and I'm called by the European Commission to evaluate, to assess, to monitor very, very complex scientific problems. They entrusted to me the writing of the report on Europe's biggest scientific project; the European Fusion Program – \$US700 million a year we spend on fusion. I certainly knew nothing about plasma physics when I started out, and if I now know anything, it's because I was bombarded with some of the best brains in Europe for six months. In the end, it wasn't my knowledge of plasma physics which enabled me to write the report, it was my appreciation of what a society is going to demand of an energy source in the 21st Century. And I can assure

you the plasma physicists know even less than I do about that."

In Australia, there is a tendency towards short-term decisions and a lack of commitment from managers to the longer-term future of the organisation, beyond their own term of office. Long-term thinking, says Ruscoe, is "not in the Anglo-Saxon tradition. One of the problems with Anglo-Saxon business methods – and I speak therefore both for the UK and the U.S. – is this short-term insistence on short-term profits. In a sense it goes with having a very sophisticated stock market, because therefore the market price varies and it is attuned to what is happening *now*. This is not necessarily a good thing when you're talking about massive – I'm talking really massive – investment for a long-term future. If you see the new technology as above all an information and communications technology as an infrastructural sea-change that we're going to actually have to throw out everything we've got so far because it's going to change our entire way of doing everything, from waking, sleeping, eating, working – everything will change – then you can't base that on short-term financing, short-term economic analysis or market trends."

Australia, says Ruscoe, is "in a way, very like England. There are many things which are interesting in the British experience of being a nation state, but there are many things which are extremely damaging – the damaging ones are the ones which have prevailed over the last 30 years. As a futurist I would look very hard at those aspects of Australia which most reflect Britain, and see whether they are actually positive for this country, whether they were positive for Britain, and whether there aren't other ways of doing it. Because if you follow the British way, then it's very much a primrose path, and it's very much downhill."

James Ruscoe is an associate of the Australian Commission for the Future.

We believe that we are moving rapidly from an industrial era in which material values of growth, status and production were dominant, into an era where people's psychological and spiritual growth will become more important.

CHRISTINE MACNULTY



Christine MacNulty recently visited her primary school teacher, whom she had not seen since she was 14, to thank him for introducing her to the world of ideas. His early inspiration, she says, was an important influence in her choice of career as a futures researcher. "And it's such a fascinating field that none of us can stop thinking about it. We're always discussing change, the way long-term trends are playing themselves out, history and how it got us to the present."

MacNulty is managing director of the London-based consultancy, Applied Futures. They work with corporations, mostly large manufacturers, helping them to develop long-term visions and the strategies with which to achieve these visions. The emphasis is very much on working with. "Early on we discovered that if we went to clients with ready-made views of the future, they were perceived either as obvious or wrong – obvious if they agreed with the client's preconceptions,

and wrong if they didn't. In either case the clients wondered why they'd hired us."

So they developed an interactive approach to scenario building. "We work for clients in an advisory, mentoring, almost psychotherapeutic fashion. Many clients are not geared to cope with change. Even though they may come up with a vision for the future, when it comes to contemplating the strategies they'll need to implement to realise that vision, they get cold feet. We act as futurists when helping clients to think about the future, and coaches and therapists when helping them to get to grips with that future."

"For example, a person's mindset may not allow them to contemplate the kind of futures that may be suggested. This can be serious if as a futurist you see major problems or opportunities emerging for a company, but that company's managers are not willing to look at them." So in their workshops, MacNulty and her team set about



changing the way managers perceive the world to help them achieve their desired futures.

They do this by helping them to think through various scenarios. They start with a set of agreed basic assumptions, and then place their clients 15 or 20 years in the future. From this vantage point, they are asked how the basic assumptions will play out. They start with aspects that clients can relate to easily – typical people such as teenagers, young couples, families, retirees, choices in homes, education, work, leisure – and arrive, finally, at their industry. Clients are continually reminded of the initial basic assumptions and asked to think about what would really happen in the future world they are contemplating.

If the workshop is successful, then MacNulty sees a moment of transformation, when participants begin to perceive the world differently. "When they take the results of our work down to lower divisions of the company, which we show them how to do, it will affect the same kind of transformation." And these changes will percolate through to other people in the organisation, as well as to their families and communities, says MacNulty. It is in this way that futures can have an impact on society, she believes, 'through its effect on individuals and small groups who hopefully will take it further. I don't think it will have any earth-shattering effect on national governments or global organisations."

Although her background is in mathematics, and her early career involved rather mechanistic forecasting of technological change for high-tech companies in the military-industrial complex, MacNulty has come to believe that the main driving force of change is people's values, beliefs and motivations. Every other year Applied Futures participate in a massive survey in Britain and a

ty to go through certain levels of development. Previously, due to family circumstances, financial constraints, community pressures, tradition, and so on, people have tended to stay at the level of their parent. With the effects of two world wars, increased material wealth, more free time, social mobility and global communications, people have probably been able to expand their psychological development. As to the question of nature or nurture, I do believe there is also a strong element of nature – people's consciousness of what's possible seems to have expanded. Humans are evolving." Looking at the

future through the perspective of this paradigm shift, MacNulty is optimistic: "I don't see any technological Armageddon. The majority of scientists and technologists are these leading-edge people, so we see them being much more thoughtful about the way they develop science and technology and the uses to which it is put." But she does foresee turbulence for the next decade, or even longer. "Those people who don't want change will try to hold on to old structures, and may feel so threatened by changes taking place that they resort to violence, terrorism or war. But there are definite trends towards increasing responsibility for one's actions towards other people, the environment, and so on. Ultimately this will prevail over structural rigidities."

And what will life be like at the end of the S-curve in 2020? "The whole set of priorities with which we start life will be different. Rather than going to school to acquire skills needed for jobs in later life, our education will resemble the kind of education that Renaissance men and women had. We'll need to learn the three Rs, but after that education will be about pulling things out from inside rather than stuffing facts in. Children will be encouraged to develop themselves physically, psychologically and spiritually. Our identities will no longer be tied up with work. There will be more choice available and the pattern of time use will be quite different. People may have different jobs over the course of one career, maybe even in parallel."

What about the environmental problems which loom so ominously over our future? "I believe in self-regulating systems. The Earth is far more durable than many believe. People tend to think about the planet from a very anthropocentric point of view, but I think the possibility of the human race destroying itself is far less than it was in the '60s. We may trigger effects, such as famine and drought, that may get rid of large numbers of us, but in the long term there'll be enough of us left to carry on the human race – and that is my absolute worst case scenario."

Dr Christine MacNulty of Applied Futures is an associate of the Commission for the Future.



number of other countries to find out what these changes are. The information they have gathered has led them to develop the concept of paradigm shift, which they think explains many of the changes occurring in the Western world.


"We believe we are moving rapidly from an industrial era in which material values of growth, status and production were dominant, into an era where people's psychological and spiritual growth will become more important." Paradigm shifts do not happen very often: the last one was probably at the time of the Renaissance, believes MacNulty. "If paradigm shifts occur in S-shaped curves, we were at the bottom of this one in 1850, we turned the corner in 1960, we're now rushing up the steep part of the curve, and by 2010-2020 we'll reach the asymptote."

Where has this paradigm shift come from? "At the leading edge are a group of people we call 'inner-directeds', whose main concerns are personal growth, individual freedom and responsibility, self-expression, etc. The question is, how did they arrive at their values? Developmental psychology suggests that people have the opportuni-

THE FUTURISTS

There are forces at work to wreck the planet and condemn a majority of people to a miserable future. But this is not inevitable and it is important that we focus on the very real opportunities that exist not just to save, but to improve the world.

IAN MILES

 Ian Miles's professional interest in futures grew out of a childhood passion for science fiction. The British researcher's early ambition was to work in astronautics, until he realised this would mean being part of the military. From a fascination with the future of space flight he gravitated towards an interest in the wider dimensions of social change, and studied psychology.

This training, he believes, enabled him to avoid becoming too narrowly specialised at an impressionable age. He brought this broader view of human nature and his science fiction inspired love of future exploration to his work, which for the past 20 years has involved researching futures issues around science and technology policy. The densely packed bookshelves lining the walls of his office at the University of Manchester attest to the breadth of his interests – and to the elusiveness of the paperless society, the subject of one of his recent research projects.

Miles baulks at the label futurist: "I am an analyst, and an important part of this analysis is to think about the future and the longer term aspects of what I am looking at in the present, to gain an understanding of why some trends are more important than others." Indeed, he believes that in order to study the future a willingness to stay involved in the real world is vital – only then can you combine utopian desires with realist appraisals. In addition, vision, compassion and discipline are all necessary, though he points out these qualities do not necessarily make a popularly acclaimed "successful" futurist, which often requires such self-promoting skills as rapid footwork, the ability to spot bandwagons first, and connections in the right circles.

Looking back over his own work, he chooses to highlight a study in the late '70s which constructed future scenarios by contrasting different views of the world and the future they implied. "This showed it was possible to develop visions of the future based on different understandings of the present. It is essential for long-term studies to grapple with different views of how the world works. For example, some views stress continuity, others radical breaks. Some emphasise power and conflict, others norms and consensus. Class conflict, gender relations, clashes between humans and environment, and between north and south have all been seen as the main driving

force of change, and depending on how you look at these qualities in the world, your view of the future will differ."


"One of my early failures as a futures thinker resulted from the lack of realisation that we live in a world where often the weight of large numbers of individual desires is bound to overwhelm any more collective rationality. When I was young I believed that a car was such an irrational mode of transport that it was bound to become obsolete in my lifetime – so I never learnt to drive. As events in Eastern Europe have shown, imposing bureaucratic notion of public good doesn't work very well – but it is debatable whether the benefits of the car outweigh its impacts on our quality of life in a crowded country like Britain."

More recently, Miles has focused on the information society, and what it means for everyday life. Much is written about the transition of modern economies to the information age, but Miles prefers to see the information society as a new phrase in industrial society, with very widespread use of information technologies (IT). "There are new possibilities in the way information can be stored, captured and turned into new data. The new power of IT has changed the common sense of economic activity. Supermarkets can now have daily reports of sales and respond quickly to changes in demand. Factories can retool their equipment easily because it is programmable, and so they can change the designs they are producing. Statistics can be analysed more quickly. These are important long-term trends which are leading to a more rapid pace of information processing. More and more decisions are made based on information which previously had not been available."

Looking further into the future, Miles believes that these trends and other developments will force us to think much more profoundly about what it is to be human. "Two generations from now, we will have made huge strides. There will be artificial intelligence, for better or for worse. The possibilities; control of our mental capabilities through psychotropic drugs and biofeedback will be developed. There may even be evidence of extra-terrestrial intelligence, and hopefully we will have a far better understanding of the psychological capabilities of primates and marine mammals. All of these things will throw our assumptions about what is specifically human into the melting pot and force us to reappraise what it is we value about human beings, which of our capacities we wish to enhance and how."

So what is the role of futures studies in helping us to come to grips with these issues? "It is important in helping us to ask 'what if' questions, 'how' questions, 'why not' questions – in helping us to think about why this future and not that one. Futures studies has been a very important avenue by which attention to a wide range of issues – such as global warming, demographic change, the implications of new technologies – has been spread beyond the narrow





bounds of specialists. Futures debates need to be made available to wider audiences; they must become demystified, so that they are not seen as the value-free conclusions of a giant electronic brain or the inspired products of superhuman gurus. I would hope that in time there will be fewer full-time, and many more part-time futurists, so that the futures dimension is taken much more seriously and integrated more fully into the work of many other people."

The future according to Miles is very open right now. "There are

forces at work to wreck the planet and condemn a majority of people to a miserable future. But this is not inevitable and it is important that we focus on the very real opportunities that exist not just to save, but to improve the world. There are many energetic and dedicated people working to this end."

And how does he see his future in 2010? "I will be a crabby old man of 62 saying: 'I told you so' and bemoaning the fact that anti-ageing therapies are only available to the very rich."

Young people are often trapped by the belief that they can't do anything about the future. But once they arrive at the realisation that the future depends on choices we make in our daily lives, and that we can build it ourselves, this changes their outlook and gives them hope.

ELEONARA MASINI



Thinking about the future is almost like a chemical reaction, says Eleonora Masini, who teaches futures studies at the Gregorian University in Rome. "The instant you think about it, you think of all your own wishes, hopes and feelings for the future."

She uses this "chemical reaction" in the laboratory of her student seminars to illustrate the holistic nature of futures thinking. First she asks her students to describe their own lives in 20 years' time: usually they are very optimistic. Then she asks them to do the same for their town, country or region; paradoxically, this usually produces pessimistic visions. So she points out that the two are inseparable – if you want to implement your own desired future you have to know about the future of your community, for you are in a context. You need to learn about yourself, your goals, your context, and how to change that context.

Professor Masini's career has been distinguished – she is a member of the Club of Rome, and has been president of the World Futures Studies Federation (a network of people professionally involved in futures studies). But it is her 16 years of teaching that she views as her greatest achievement, for it has enabled her to spread futures consciousness across the globe. She has seen many students become motivated in their personal and professional lives to adopt futures thinking, take it back to their own countries and put it into operation in their work. One ex-student is now working with educational institutions in the Cameroon to improve the future of the country's young people; another returned to her native Zimbabwe and galvanised rural women to take hold of their own futures by setting up a grassroots women's club; and in El Salvador women refugees are learning how to face the future with another of her students.

Masini is a strong believer in the empowering potential of futures studies – her experience at the university has shown that it often has particular potency for people in impoverished or difficult situations as a means of helping them see a more positive way out.

"Young people in particular are often trapped by the belief that they can't do anything about the future, that it is beyond them and created by others. But once they arrive at the realisation that the future depends on choices we make in our daily lives, and that we can build it ourselves, this changes their outlook and gives them hope."

After initially training as a lawyer, Masini changed to sociology, specialising in social change. Her discovery of futures studies came at the end of the '60s. She was finding that no available theory of social change seemed to answer the great dynamics of that time: "Sociological analysis was never enough to capture what was going on – once the analysis is finished everything has changed again, and what do you do then? It was disillusionment that led me to futures studies. I stumbled across the writings of Bertrand de Jouvenel and Johan Galtung . . . and the rest followed."

She has just finished co-ordinating nine years of research by women in developing countries to produce a book on *Women, Households and Change*. Her use of the futures dimension in social analysis is clear in fieldwork she has carried out on women's issues: Going beyond pure extrapolation to look at the desires and aspirations of women has been very important. "It's not enough to state what is happening to women, you need to hear what their expectations for the future are and what they want for their daughters – this gives you an immediate projection into the future."

Women have a very important role to play in a new society of the future, she believes. They are able to capture the seeds of change lying beneath the surface, and often have greater flexibility of mind than men, perhaps because they have less invested in present power structures. "They have power in a different way, behind the scenes – women are becoming more and more self-aware, not in terms of power structures but in terms of power in themselves and in their everyday lives."

She feels it is vital that women should become more involved in

futures studies, for they often have the kind of capacities she believes it requires. "A futurist must be able to listen to the less obvious seeds of change – it is easy, for instance, to see the effects of biotechnology, but futurists need to develop a sensitivity to the effects of the subtle awareness that people have been developing over the past 20 years. They must also be as open-minded as possible to space and time. Whatever the futurist is trying to describe or foresee is only one of many possible futures, and without a sensitivity to other futures in other space and time, any technical capacity goes haywire."

The most important changes for the future are occurring in the areas of cultures, value systems, beliefs and behaviour, Masini believes. Those studying Eastern Europe attentively would have foreseen the recent cultural and ethnic explosions in such hidden trends as growing restlessness on the part of the populations, their close attention to the West, their loss of communist identity and their growing nationalist sentiment. Unfortunately, she feels many futurists are not prepared for cultural change because they stick to the safety of quantitative methods. But it is in the qualitative fields that the dynamics of the future lie, she believes. On the one hand she sees an irreversible rise in people's awareness – in women, in minorities, in developing countries. Although this is not unidirectional, and not all positive, it has a positive backbone – people are becoming

empowered. On the other hand she sees a great potential for conflict over the next 20 years as this growing awareness clashes with inflexible institutions and structures. Worldwide she sees family, schools, state, unions and so on failing to adapt in an acceptable way to this rise in people's consciousness.

But watching her two grandchildren grow up gives her a sense of optimism. "They attend a school with children

from many other ethnic backgrounds, so they are used to different names, different ways of speaking, different clothing, etc.

This makes them much more able to cope with differences and uncertainties than was my generation" – which she believes will be invaluable, for their future world will present them with a continually stimulating environment of differences in others and of different others.

What will these changes mean for the future of Australia? Masini believes that Australia too needs to learn to accept the cultural differences within itself if it is to survive and grow. Regardless of technological developments, Australia will always be far away from the rest of the world in terms of human relations, she says. So to thrive in a future world of diversity it will need to learn both to open itself up to the world outside through long-distance communications, and to be open also to its own rich inner diversity.



Now, as times have changed and the old sources of income are beginning to look less reliable, there is a turning towards the future, and a questioning about how long things can go on like this.

RICK SLAUGHTER



In the world of the futurist, the choice of field and specialisation is vast and challenging. Rick Slaughter, English-born, has until recently chosen to sit in front of a Macintosh computer in a small office on the grounds of Melbourne University assailed by young students to whom the area of futures has become an option for *their* future path. Slaughter's office is cluttered with books: academic treatises on the realm of futures alongside the fictional work of J.G. Ballard, Brian Aldiss and Ursula LeGuin, books on comics and cinematic depictions of science fiction and boxes of adolescent sf pulp from the '50s onwards. In the filing cabinets are graphics and photographs of futuristic cities. As

Slaughter says, there is little that a futurist can ignore. Indeed, over lunch, he launches into enthusiastic discourse about Ridley Scott's classic science fiction film *Bladerunner* and the video he had watched the previous night, *Darkman*.

Slaughter began his teaching career in Britain in the late 1960s and holds a Ph.D from the University of Lancaster on the role of futures studies in education. Slaughter has pointed out that not many people, especially in Australia, understand the concept of futures studies. On the one hand is the reference to the future in popular culture – science fiction films, television shows, graphic novels and comics – portraying the future in often simplistic or stereotyped forms. Then

there is the output of futures research and studies, often tending towards the esoteric or academic. All too often the language is difficult and specialised, the concepts demanding, the ideas controversial.

The young Slaughter saw the future as teeming with possibilities: "It follows that it's up to us at any time, in any generation, to look at the evolving picture and to respond to it in ways that seem appropriate. Obviously we want to avoid some sorts of futures. Dystopian futures which show things going wrong represent warnings about aspects of our present world that we would do well to think about and deal with, the futures that they imply – nuclear warfare, ecocide, overpopulation are things that we explicitly take action to avoid. On the other hand, there are many possible futures that we need to understand so that we can choose among those worth going for."

Slaughter believes good science fiction is the beginning of generating a vocabulary, images and a language – to engage with things which have not yet occurred. "From that point of view it makes sense to utilise these images and discourses about the future. On the other hand, many current representations of futures in modern culture are, in my view, quite spurious. They are driven by fairly primitive impulses such as greed, fear and power fantasies. They are often Western, male, high-tech oriented scenarios which have little credibility." Slaughter cites such bleak cinematic visions expressed in *Robocop*, and *The Terminator* alongside *Star Wars* and its successors.

"The default future can be a spuriously optimistic one, in which technology comes to solve all the major problems and moves us to new stages of civilisation.

That technology is *secondary* to human impulses. The kind of technologies we get are consequent upon what human systems have put into them. If we put paranoia into a technical system, we get a Strategic Defense

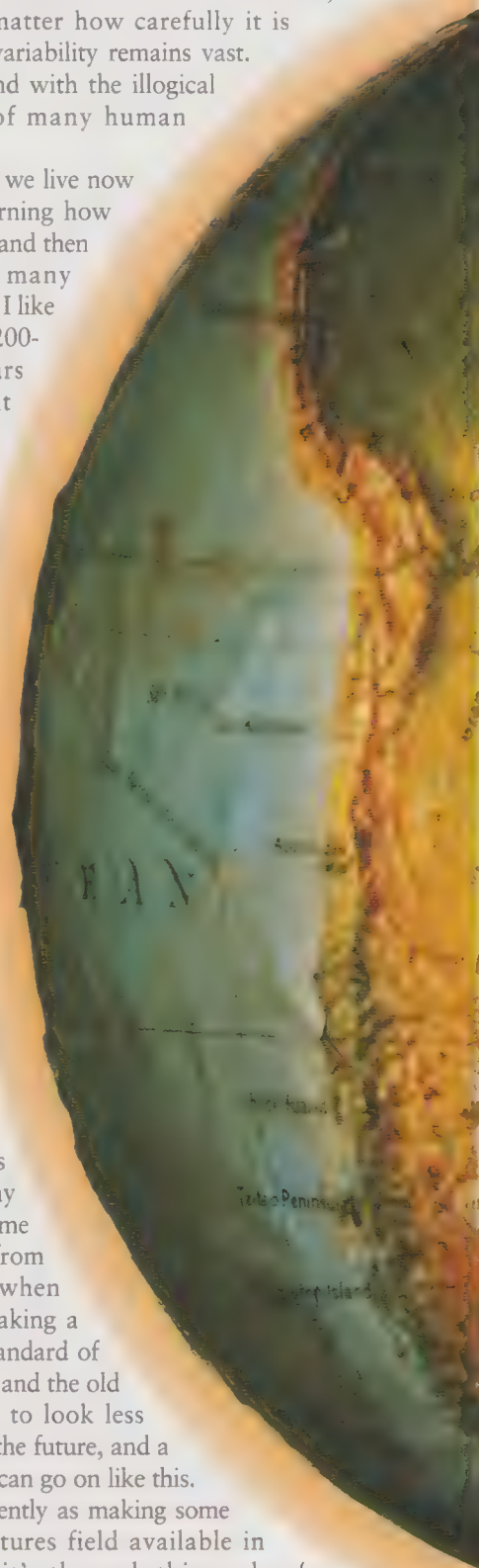
Initiative – a *Star Wars* scenario which is highly destructive and diversionary of talent and materials. Whereas if we put in motives such as stewardship and caring, for each other, for the planet, then we can implement a different set of technical systems and move towards a different range of futures."

Slaughter sees much popular culture as presenting working material, "but we have to be careful with that material, because it does not always mean what it appears to mean. I've noticed from looking at a lot of children's literature, film, video, TV, that a dominant theme emerges; a future constructed externally through science and technology. That is the modern myth which writers like Ballard, E.M. Forster and others are happy to deconstruct. But it is so frequently repeated that I suspect many people actually carry this implicit notion inside their minds: that the future is built in that external way, rather than through the many micro-decisions that people, groups, organisations and nations make on a day by day basis. For me the future is essentially a human domain, rather than a technical one. The study of futures is about the active role of humans

in shaping their world".

One of the on-going variables and problems with the serious studies of futures is, regardless of assessments made of current facts, information and data, and no matter how carefully it is projected, the human element of variability remains vast. How does a futures expert contend with the illogical nature, the unpredictability, of many human decisions?

"The decision context in which we live now is based on looking back and learning how things got to where they are today, and then extended by looking ahead in many different ways. So that's partly why I like to use Elise Boulding's notion of a 200-year present, stretching 100 years back and 100 years forward; it defines our context in time. We can study the roots of our present in the past 100 years; we can discern the main trends. From this point we can look ahead at the alternatives. We cannot predict, but we can understand alternatives. Futures is partly about establishing a clear picture of the options and possibilities at any one time which can emerge, fan-like, out of the present. "The main reason, perhaps, that futures hasn't quite yet emerged as a recognised discipline is that it's still fairly young. We're talking about something that is 40 to 50 years old in its modern form. It takes time for a disciplinary paradigm to be defined and to go through stages of legitimisation and eventually to settle into a viable pattern. That's happening now. Another factor may be that Australia has inherited some short-term colonial assumptions from Europe, which were congenial when times were easy. Australia was making a lot of money, it had a very high standard of living. Now, as times have changed and the old sources of income are beginning to look less reliable, there is a turning towards the future, and a questioning about how long things can go on like this. I've seen my primary role until recently as making some of the symbolic riches of the futures field available in educational contexts, because it's through this cycle of educational development that our society renews itself, and also, with luck, renews its vision of the world."



It's the anxiety of the future, and there's no way out

TECHN

In the flesh and blood present, it's easy to tell the real from the artificial. But in a future world, when even the machines have warm faces, deciding in a split-second what is real might mean life or death.

BY MCKENZIE WARK

OF FEAR



Robocop



Total Recall

Technology has invaded the pores of our skin and our unconscious minds

Most people consider home video to be an escape from politics and the work-a-day world. Yet even that most escapist of movie genres, science fiction, is very much anchored in everyday problems of the experience of technology. Indeed, escape movies "work" precisely by providing imaginary solutions to very real problems. Science fiction movies come in a number of types, but the ones which are most interesting and popular are the ones I would call the Tech Noir genre – black technology stories. While movies of this type borrow from a number of other work-a-day genres including the mystery, Gothic horror and, especially, the western, more than they all deal with the problem of "technology".

Science fiction movies are often divided into two main categories: hard science fiction and soft science fiction. Hard science fiction is concerned with the technical aspects of technology – technology. Tech noir, it stems partly from a growing suspicion about technology, which is undoubtedly occurring today and is linked to environmental concerns. It goes further and asks a more challenging question: Is it possible to distinguish the human from the inhuman? If technology is something to be feared, is there a sense of the "human" any more which is not fatally compromised by technology?

Tech Noir movies frame the problem of technofear by means of stories which are about "undecidable" cases – things which are not quite human and not quite technological. The definition of both then hinges on a story which "decides" one way or another about the undecidable, often a kind of "android" figure in between.

In the popular movie *Robocop*, the central character is a cop who is injured in a shootout with the bad guys who will later turn out to be in the pay of Omni Consumer Products, the corporation which made him and which runs the police force as a privatised service to the city government. Robocop is essentially a man with robotic prostheses. He wins out over the bad guys by upholding the law, but he also triumphs over a rival law enforcement "product" – a robot called Ed II which lacks any human judgement. While robocop is mostly machine, he is acceptable in the end as an "undecidable" being, somewhere between culture and technology, because his human judgement still has control over his technical powers.

An opposite case is *The Terminator*, in which the bad, destructive machine is clothed in living human flesh. The humans who battle with the terminator are not only fighting for their lives, but fighting against

the nightmare vision of the future in which technology has completely subjugated culture. The undecidable in this case has to be exterminated before it exterminates all that is human. In *Terminator 2* the underlying moral dilemma is rather more complex. In this sequel, there is a "good" undecidable which battles against a bad one – the point being that there is a balance in the mix between the human and the technological beyond which it is dangerous to go. In battling the excesses of technology, ironically enough, technology is still necessary.

More complex still is the classic Tech Noir film *Blade Runner*, in which the undecidables are the product of a biotechnology which can make replicas of humans, called, appropriately enough, replicants. In the film, these have reached a stage where their maker, the Tyrell Corporation, can endow them with memory, thus giving them the illusion that they are indeed human. Replicants are used as slave labour in the "off world colonies". When they escape and return to earth they are hunted down and killed by "blade runners" like Rick Deckard, the central character. What makes the story interesting is how the fact that Deckard kills in line with a regulation and disappears near the border with his conscience, a bond between the human and what might best be called "post-human". It's more disturbing still, however, that the replicants are more human than the humans. The fact that they are more human than the humans is the most disturbing of all, that by becoming human they are also post-human, in a way as life he is a barbaric and inhuman thing.

Blade Runner is so far the most challenging Tech Noir film because it raises the possibility that the difference between the human and the inhuman, between culture and technology, is too far gone to be unscrambled. There can be no naive appeals to "human nature" or a return to nature when the human is a product of the technical as much, if not more, than vice versa.

The question arises as to how this overpowering of the cultural by the technical came about. Tech Noir films at their best suggest an appropriate answer to this – the bad corporation. The makers of robocop and the replicant are two such bad corporations, suggesting a world where corporate power has run amok, subsuming cultural values under the remorseless quest for profit, as it were. The film *Aliens* goes one better, suggesting that the megacorporation is responsible for an environmental recklessness which unleashes the alien on unsuspecting people – a nightmare vision of "bad nature" let loose by big business and big government.

These films don't simply blame business for technological problems, however. In both *Robocop* and *Blade Runner*, the undecidable man machine turns on its corporate maker and kills him. Business is also caught up in a technological dynamic gone out of control. Big business might have more power than the individual, but it too has to compete and struggle in a technological environment which even the most powerful organisations do not control.

The competition for profit drives a desire for new technology, which not only divorces itself from human need but feeds back into



PHOTOGRAPHER DAVID JOHNS / PACIFIC EYE

Fate rolls the dice for us each day, influencing our habits
and patterns. We take simple decisions that have the
potential to change our lives, for better or for worse.
Nations fall, worlds collide, all according to probability.

RISKY BUSINESS

BY GRIFF CLEMENS

When we think of risk-takers our first image is usually of daredevil stuntmen or ice-cool entrepreneurs, but we all live with risk from the moment of conception. Being born is likely to be the most dangerous activity you are ever involved in. On the basis of risk of death per hour of exposure, it is more than 10 times more dangerous to be born than it was to serve in the American forces in Vietnam. And, like few other activities, birth brings with it a 100 per cent probability of ultimate death.

Experts in risk assessment are quick to point out that our perception of various risks is often far from a rational analysis of the hazards we face. People are much more accepting of voluntary risks, ones they choose to take themselves, than they are of involuntary risks, those imposed by others. The same person who is prepared to paddle off on a canoeing holiday (one estimate suggests 500 chances

of death canoeing per million participants per year based on 50 hours of exposure) may well decide that living near a well-run chemical plant is far too dangerous (perhaps one chance in a million of death per year based on a 24-hour-a-day exposure). We fear dangers that we find unfamiliar, over-estimating the hazards associated with rare adversities and underestimating familiar ones. A picnic spot may be rejected because of the danger of snakes, but the far more hazardous car trip home is not given a second thought.

Perhaps most of all, we feel uneasy about the unknown risks that lie in the future. The tragic accident that befell Australian boxing great Johnny Famechon is an indication of just how fickle probability can be. After surviving at the top in the most dangerous of sports, he was forced to fight for his life after being struck by a car while crossing the road. Surviving unscathed as a world champion boxer (facing a one in 1000 chance of death for each 150 hours spent in the ring) had no influence on the one in 10,000 chance per year of death Famechon faced as a pedestrian.

There is nothing new about trying to foretell the future. Ancient rulers and recent presidents have used various priests, astrologers and soothsayers to advise them. As the risks faced by society have increasingly come from technological activities, scientists and engineers have become the new shamans, advising those with power of the likely consequences of their actions. The discipline of quantitative risk assessment has been developed to provide information on the probability of various hazards causing accidents, and how the outcomes are likely to affect us. Using historical data, statistical methods, computer modelling and a detailed knowledge of the technologies involved, risk assessments are becoming an increasingly important part of policy formulation in both the public and private sectors. In the past, many risks were perceived as so obvious that there was little analysis beyond an understanding of what they were, and what was needed to control them. But the risks associated with an exploding steam boiler are much clearer than those related to the operations of a petrochemical plant, the use of a pervasive chemical such as formaldehyde, or mining operations in an environmentally sensitive area like Coronation Hill in the Northern Territory.

Bob Wagstaff of Commercial Union Insurance points out that risk assessment has long been the basis of the insurance industry. "Premiums for common risks such as domestic burglary and fire, or car accidents, are set by reviewing the historical record and assessing the likelihood of a payout," he says. "It is a relatively simple operation when the risks are clearly understood and there are large numbers of policy holders reducing the likelihood of abnormally high numbers of claims in any given year. But when you're faced with setting a premium for a complex industrial activity, the task becomes significantly more complicated."

Risk assessors can use methods similar to the actuarial approach to produce risk levels for various activities which may then be used to shape public policy and the future. Civil aviation expert Dick Smith caused a controversy when he suggested that some aviation safety measures could be modified without leading to any overall increase of risk to the community. He argued that changes could reduce the cost of flying without significantly increasing the risk. This would then make it possible for more people to travel by air than far more dangerous cars and trains. There was little debate about the logic of the argument. Unlike many other risks, the relative dangers of flying and driving are well known. Or are they?

A recent General Motors study looking at travel safety highlighted some of the problems associated with reasonably simple risk assessments. At first glance, the solution appears clear – there are 0.55 fatalities per billion [1000 m] passenger miles flown, compared to 12.56 fatalities per billion passenger miles driven. But the data is aggregated,

and the crashes of hormone-fuelled teenagers driving poorly maintained cars are lumped in with the relatively small number of accidents involving sober accountants. The study concludes that if your lifestyle falls towards the accountant end of the curve, and your trip is less than 500 kilometres (possibly in a light aircraft), driving is twice as safe as flying.

Adding to the confusion, and the fear of flying, an English study points out that there are 1.8 deaths per million passenger journeys by air, compared to 0.027 deaths per million car trips. The explanation is simple; the average plane trip is 100 times longer than that by car. Clearly the findings of a risk analysis will depend on the design of the study and the quality and quantity of the data analysed. The problems associated with quantitative risk assessment become more significant when the assessor attempts to look into the future and determine the risks associated with activities and systems that do not have a long history or are still at the planning stage.

This type of risk assessment began to develop quickly in the nuclear age. Obviously, there were significant potential hazards associated with nuclear power plants. But there was no historical record to consult to estimate what type of risks they posed and the probability of an

accident occurring. A predictive approach based on the actual plants being designed was essential for the meaningful prediction of risk to be obtained. In Australia, quantitative risk assessments on what have been called low-probability high-consequence risks have most commonly been undertaken on developments in the chemical industry. Because of the use of new process components and the increased scale of operations, it is not generally possible to predict the performance of new plants by extrapolating the accident experience of the past.

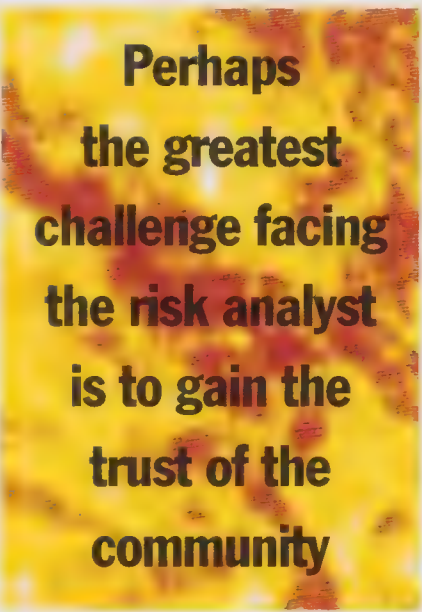
In a paper presented at the Macedon Counter Disaster College, Mr W.D.Mant, senior consultant (process safety) for ICI Australia Engineering, provided a simplified outline of the process of a quantified risk assessment. First, the process must be clearly understood – the materials involved and the physical and technological environment in which they are to

be handled. With this basic information it is possible to examine the proposed process and identify the ways in which undesirable events may occur. For each failure scenario, an assessment is made of its probability and likely consequences – the contribution that it makes to the total risk. The total risk for the proposed facility is determined by the summation of the risks from all scenarios. The risk can then be compared with a risk target to determine the facility's acceptability.

If necessary, action can be taken to reduce various risks. Adrian Simonetta, deputy manager of the dangerous goods branch of Victoria's Occupational Health and Safety Authority, points out that in practice, it is an extraordinarily complicated task. "The months of research that went into the 1987 risk assessment of Melbourne's Altona petrochemical complex culminated in four days non-stop analysis of mathematical probabilities and consequences by high-powered computer," he said. "Each significant vessel and pipeline containing flammable or toxic materials was investigated, and the consequences of everything from a small hole to a complete rupture investigated. The probability of potential failures was calculated by investigating the failure rates of similar components in existing plants and testing new equipment. The ability of the plant's safety systems to deal with different events was also factored into the model."

Sophisticated "event trees" are used to allocate the probabilities of various hazardous outcomes. A leak of flammable material may lead to a fire or explosion in the plant. It may cause a drifting vapour cloud, leading to a flash fire or explosion in the surrounding area, or the cloud may disperse harmlessly.

"Consequence models" are used to predict the effect of potential hazardous events. There are models for all sorts of unpleasant out-



**Perhaps
the greatest
challenge facing
the risk analyst
is to gain the
trust of the
community**



Coode Island blaze, Melbourne 1991

THERE IS A ONE IN A MILLION RISK OF DEATH FROM THE FOLLOWING

1½ Cigarettes
50 miles of travel in a car
250 miles by air
11½ minutes of rock climbing
6 minutes of canoeing
20 minutes of being a man aged 60
1 to 2 weeks factory work

Source: Whyte, Burton: Environmental Risk Assessment

RISK LIST

RISK ASSOCIATED WITH SPORT

Deaths per million participant hours in the UK.

Amateur boxing (1946 - 62)	0.5
Canoeing (1960 - 62)	10
Rock climbing (1961)	40
Scuba diving (1970 - 79)	220
Hang Gliding (1977 - 79)	1500

Source: Risk Assessment. A Study Group Report.
The Royal Society. 1983

HAZARD AND RISK LEVELS

(chance in a million per year per person)

Voluntary

TYPE OF HAZARD	RISK OF DEATH
Smoking (20 cigarettes/day)*	5000
Motoring in New South Wales	300
Railway staff in the U.K.*	180
Motoring in the U.K.	177
Motoring in Victoria	144
Drowning in Victoria	15
Playing football	40
Rock climbing*	40
Working in United Kingdom chemical plants*	40
Taking contraceptive pills*	20
Train accidents in New South Wales	10
Air crashes in Victoria (private aviation)	3

Involuntary

TYPE OF HAZARD	RISK OF DEATH
Run over by a car in New South Wales	100
Falls in Victoria	66
Leukaemia in UK	50
Fire in houses	20
Accidental suffocation by food in Victoria	7
Explosions	5
Struck by falling object in Victoria	4
Struck by lightning in the UK	3
Unexpected reaction to medicine in Victoria	1
Bushfires in Australia	1
Poisonous spider bites in NSW	0.2
Struck by lightning in Victoria	0.2
Explosions from pressure vessels in the USA	0.05

RISKS ASSOCIATED WITH TRAVEL

Deaths per billion kilometres travelled (UK 1972 - 76)

Railway passengers	0.45
Scheduled airline passengers	1.40
Car or taxi	8
Pedal cyclist	85

*Voluntary activities for which only the exposed population is considered
Sources: Technica 1987 & Department of Environment & Planning N.S.W. 1985

comes; pool fires, flash fires, explosions, drifting heavy vapour clouds and toxic impacts. The final stage is the calculation of a total community risk level. Risk contours can be drawn around a proposed plant showing the likelihood of individuals at various locations being affected by an accident at the plant. The probability of large accidents affecting more than one person, group risk, is shown by a graph that plots the cumulative risk of multiple death versus the number of fatalities. It is not surprising that quantitative risk assessment has become a powerful tool in the formation of public policy in areas such as industrial safety and land-use planning. The end product of the study provides government with a probabilistic crystal ball.

The problem is that large numbers of the public and some professionals do not trust the results. Yale sociologist Charles Perrow questions whether it is possible to quantify all the sources of accidents arising in complex systems such as nuclear power plants and chemical complexes. He suggests that by their nature, these systems are highly interactive, and one failure is likely to cause an unforeseen outcome somewhere else in the system. In the first 13 seconds of the Three Mile Island nuclear power station accident, four separate failures occurred. The system was interactive, but the failures were not linked in a clear linear fashion. The operators were confused and no risk analyst could ever have been expected to model the situation.

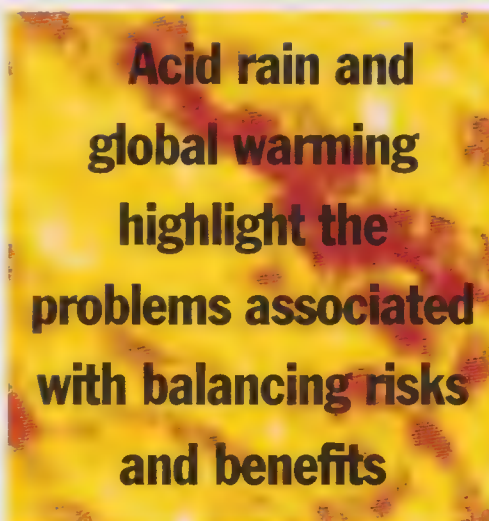
John G. Kemeny, who headed the Presidential Commission on Three Mile Island, said: "Something unexpected can always happen. That is the lesson. All you can do is cut down the possibilities." Paul Adams of Melbourne's Hazardous Materials Action Group points out that well-intentioned risk analysts are often forced to overlook potentially significant risks because they lack data. "In a study of the risks associated with the Coode Island terminal, the consultants pointed out that plume analysis of some chemicals like isocyanates were not carried out. Perhaps the risks are not significant, but it's difficult for a concerned resident to take these statements on trust. In most assessments, analysis is only done on the effects of each individual chemical, consideration is seldom given to the effects of exposure to 'cocktails' of chemicals, or exposure to toxic combustion products associated with a fire like we had at Coode Island."

For all the complexity of the process, risk assessments often use the crudest of indicators for possible effects – human deaths. In most cases, it is impossible to model the consequences of accidents that do not lead to a sudden death. Long-term health effects of small accidents, or those involving chemicals with low toxicity, must be ignored. Excellent records are kept of fatalities, allowing the comparison of different risks and the definition of an "acceptable level" of risk. The commonly used level of acceptable risk of one in a million chance of death per year has led one Greenpeace activist to comment: "When your friends say you are one in a million, they are probably paying you a compliment. When a risk assessor does it, it may mean you are going to die."

There is heated debate about what constitutes an acceptable risk. A recent article in *Engineers Australia* quoted the Resource Assessment Commission's report on proposals for mining at Coronation Hill as saying: "... the probability of a major accident affecting the environment was estimated to be less than one in 10,000 for each year of operation. The question remains whether this low level of risk is acceptable. Very few criteria have been formulated to give the upper tolerable limit for the frequency of incidents affecting the environment." The article points out that in giving its reasons for rejecting the proposal, the Government specifically mentioned the danger posed to the environment. The Government considered even the low identified risk significant.

The rapidly growing field of environmental risk assessment requires not only a clear understanding of the industrial process posing the risk, but also a detailed knowledge of natural systems that may be affected. An assessment of even a relatively simple development, such as an ocean sewerage outfall, often leads to complex and inconclusive debate about the possible emissions and their effect on plant and animal life. The difficulty of quantifying environmental risks grows with the complexity of the problem. As early as 1691 the English diarist John Evelyn referred to complaints from the French about "being infected with smoakes driven from our Maratime Coasts, which injured their Vines in Flower". Today's problem of acid-rain is an example of the way that one person's, or country's, risk can become another's hazard. The international basis of the hazards of acid rain and global warming highlight the problems associated with balancing the costs, or risks, associated with various activities and the benefits they will bring.

Canadians watching their forests die are unlikely to consider that



the risk of environmental devastation is justified by the need for growth in the US economy. At both the local and international level, people will assess the acceptability of a risk as much by their perception of the benefits associated with an activity as by hazards that may be generated. It is often as difficult to achieve a consensus on the benefits likely to derive from "risky" business as it is to estimate the risk itself. Jet air travel is a contributing factor to high-level ozone depletion. Should we limit recreational travel in an attempt to reduce the risk of skin cancer? Considerable resources worldwide are going into the refinement of quantitative risk assessment for a seemingly endless number of applications. Advances in computer hardware have led to

an explosion in the type of software available. Melbourne consulting risk engineers Viner Robinson Jarman have produced the VRJHAZ-AN programme for desktop use. "One of our aims is to develop highly interactive software," says company director Mark Jarman. "For example, the program allows us to interrogate the results at any point within a facility, providing management with data that can be used to investigate methods of risk reduction. It is important that management understands how they can make use of the program."

The identification of hazardous situations that may lead to catastrophic results is one of the major benefits of risk assessment; even flawed studies will lead to actions to reduce risks. Eyewitnesses claim that the first explosions during this year's Coode Island chemical storage fire destroyed an important part of the plant's fire control system. If risk assessments are to be of real benefit, they must foresee such outcomes and investigate engineering solutions. But perhaps the greatest challenge facing the risk analyst is to gain the trust of the community.

Talking of a proposed high temperature incinerator, Gavan McDonnell, convenor of the Australian federal-state joint taskforce on the management and disposal of intractable waste, said: "I couldn't possibly become familiar in detail with all the evidence for and against incinerators, I had to take it on trust, so it is that I and everybody else don't have good risk estimates for most of life's chances. We wouldn't know what to do with them if we did. The way we organise our lives is not done on the basis of scientific or technical risk estimates, but on trust, or something like it."

If risk assessments are to become an increasingly important part of public policy formulation, they must be trusted by those affected. A way must be found for significant public participation in this highly complex discipline. For, unlike the pronouncements of the soothsayers of old, the assertions of the risk analyst will only be accepted if the public understands the process that has led to their predictions.

Griff Clemens is a freelance writer.



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LOOK BUT DON'T TOUCH

BY GARY WALSH

Tourism brings money, but it also brings people. And the people are coming in such numbers that they present a threat to the very landscape they come to see. It's a dilemma Australia must resolve.

On Queensland's Magnetic Island, the landscape is defaced by the scars of a stalled tourism development, hills levelled, beaches gouged, trees and undergrowth stripped bare; at Hamilton Island, 21-storey accommodation towers loom over a pretty Whitsundays beach, and captive dolphins perform tricks in a swimming pool; on a remote peninsula in the Northern Territory, a tourism development wins an international award for its environmental sensitivity in a region of great ecological fragility. Australian tourism's impact on the environment manifests itself in various ways.

There is now general acceptance that the tourism industry must become conscious of its symbiotic relationship with the environment. Recent events testify to this increasing recognition: the Federal Government has made tourism the focus of one of its working groups on ecologically sustainable development, tourism's peak industry body has issued an environmental code of practice for its members, and the CSIRO and the Northern Territory Conservation Commission have devised a geographic information system for the McDonnell Ranges to determine where tourism projects can take place while maintaining the conservation value of this arid zone, a system designed as a prototype for future planning throughout Australia.

In the same week in 1990 that Hamilton Island opened its Gold Coast-style hotel blocks, the Australian Tourism Industry Association (ATIA) released its Code of Environmental Practice for the





Uluru/Kata Tjuta National Park

Tourists climbing to the summit have worn away rock on the main walking path. Four-wheel drive tyre marks believed to be a decade old can still be seen in the desert terrain. Four-wheel drive access compacts soil, damages vegetation, changes runoff patterns and disturbs dry river beds. As in all arid and semi-arid regions, vegetation recovers slowly from even minimal impacts of human visitation, and short germination and breeding seasons mean greater sensitivity to external shocks. Seasonal use of these regions add to the shock of impact. Contamination of limited groundwater is also identified as a problem.

Visitor numbers and forecasts:

1980	75,600
1985	110,000
1990	250,000
1995	304,000
1997	329,000
2000	370,000

Source: National Parks and Wildlife Service

Great Barrier Reef Marine Park and coastal zones

Coral damaged by silt created by coastal development and the construction of the Bloomfield Road through Cape Tribulation National Park, where the reef reaches its nearest point to the coast. Superficial damage to reef formations by scuba divers, snorkellers and reef walkers. Pollution from boats illegally dumping sewage and waste products. In coastal areas, tourism has contributed to destabilisation of sand dunes, beach and dune erosion, decreased diversity of native vegetation and some loss of species. Preference for water frontage and coastal views has meant the destruction of less visually attractive, but environmentally significant, areas such as wetlands and mangrove swamps. The loss of wetlands to property and tourism development can affect fish breeding and feeding grounds. "State of the Environment" report in 1983 said 89 percent of the estuarine and freshwater wetlands in the south-east of South Australia had been lost, along with 50 per cent in Victoria and 38 per cent in NSW.

Domestic visitor figures are for the 1989-90 financial year, international figures for 1989 calendar year. Statistics are based on at least one overnight stay. No forecasts of future visitations have been made.


	NUMBER OF VISITORS	NIGHTS STAYED
Rockhampton		
Domestic arrivals	1,076,000	3,734,000
international	82,000	499,000
Mackay		
Domestic	826,000	785,000
International	63,000	72,000

Townsville		
Domestic	937,000	3,292,000
International	153,000	121,000

Calms		
Domestic	1,163,000	5,486,000
International	304,000	2,702,000

Barrier Reef islands		
Domestic	115,000	501,000
International	107,000	521,000

Source: Bureau of Tourism Research



industry, which was followed by a set of environmental guidelines for tourism developments. The code of practice was prepared over two years through consultation with Federal and State governments, environment groups and tourism organisations, as "a philosophical framework" for environmentally responsible tourism.

Importantly, the code set no strict rules for the industry to follow, preferring to leave that issue to government. ATIA says the document provides "education through leadership and guidance". The guidelines for development highlight the difficulty of increasing tourism while protecting irreplaceable natural attractions.

"It seems self-evident that it is in the tourism industry's interest to ensure that such resources are managed in a manner which protects their intrinsic values. Regrettably, the logic of this self-interest has not always prevailed. One result of this has been the growth of a negative image in certain sections of the community," the introduction to the document says.

The association is sensitive about its public image. Its environment strategy notes that while virtually all reporting of tourism and the environment is adverse, tourism could act as a force for environmental good by, among other things, providing an economic justification for conservation. "However, it can also have negative impacts such as pollution, erosion and aesthetic problems. These can be minimised, and in some cases converted into positives by good professional management," the strategy says.

The organisation has begun a series of workshops on the environment and tourism. Mr Geoff Buckley, head of the Sydney office of the National Centre for Studies in Travel and Tourism and the person who oversaw development of ATIA's code of practice, says the workshops represent the first serious attempt by the tourism industry to address the question of sustainable development.

"There is little doubt the long-term future of the Australian tourism industry is closely linked to conserving the natural assets that make this country such a unique tourist destination," Mr Buckley says. "Current trends in Australia suggest that in the future the emphasis will be on tourism in national parks, greater domestic and international tourist interest in the Australian natural environment and large prestige development projects, often in remote and sensitive areas.

"These trends will require the tourism industry to assume a greater responsibility in planning its development and to reflect an awareness and understanding of environmental values and associated tourist expectations." The association guidelines stress the need for consultation before development, as well as post-construction monitoring and management: "Assessments made about the impacts of a project on the environment and measures formulated to ensure the environment is protected during the life of the project are rendered null and void if the predictions were inaccurate or the protection measures are ignored once the project is built." Issues to be considered include impact on conservation areas, particularly if they have wilderness values; effects on sensitive natural resources, cultural and heritage areas, and Aboriginal sacred sites; pollution control and soil erosion.

As technology has changed, the tourism industry has adapted. What was once the exclusive domain of the hardy and adventurous (and almost by definition confined to those most committed to the preservation of the environment) so that it is now available to all. Travellers can wander along a wooden boardwalk beneath the tangled rainforest canopy of Cape Tribulation National Park, fly in a seaplane onto remote stretches of the Gordon River, or ride a fast catamaran to the Great Barrier Reef.

The unique Australian environment is recognised as a major attraction for overseas visitors. The International Visitor Survey in 1988 found that 85 per cent of Japanese visitors and more than 70 per cent of tourists from Europe and the United States listed attributes such as beautiful scenery, vastness, cleanliness, natural wonders and wildlife, and good beaches as major reasons for choosing an Australian holiday.

The tourism working group on Ecologically Sustainable Development (ESD), with representation from Federal and State governments, industry and conservation organisations, sees regional planning as essential for the future. It suggests an integrated framework of strategic tourism plans prepared by governments from local to national level "to provide a rationale and focus for ecologically sustainable tourism", as well as the imposition of effective environmental impact assessment processes.

Tourism would be one element of a process addressing all land uses and environmental systems – water catchment management, agriculture, forestry, fisheries, industry, urban settlement, conservation areas, mining energy production, infrastructure and services. Ecological sustainability might require decisions to phase out some practices, rehabilitate existing tourism sites, and in the most extreme cases, prevent tourism in certain areas of high conservation value or areas which remain substantially unaltered.

The ESD group's draft report lists in sober detail the potential damage to the environment by tourism. The construction of accommodation and service amenities and associated transport and service links create primary changes such as clearance and damage to vegetation, soil compaction and erosion, change to the hydrological conditions of rivers, estuaries and groundwater, diversion of water supply and the generation of waste. The presence of tourists can cause increased impacts including litter, sewage, exhaust fumes, traffic noise, death of wildlife, vandalism, visual pollution, loss of wilderness values and introduction of exotic species.

The senior project director for the World Wide Fund for Nature (WWF), Mr Michael Rae, agrees

that the key to sustainable tourism is strategic planning. WWF worked with the Australian Conservation Foundation (ACF) on a joint approach to the ESD inquiry. "The Government should be getting together with the tourism industry to look at the long-term view – what sort of tourists are we wanting to attract, in what sort of numbers, and into what sort of places, and how then do we deal with those people?"

While he acknowledges that such a process would be costly and time-consuming, Mr Rae believes the benefits would far outweigh the expense. "There is nothing surer that will kill the tourism industry than a growth that occurs like topsy and destroys the very things that people were coming to see. If you want to see what is the costly part of it, it's when the tourists don't come any more."

Mr Mike Hill is deputy director of the Australian National Parks and Wildlife Service (ANPWS) and a member of the ESD tourism working group. He says that while planning is important, implementing it is not a simple thing.

"It's very much a matter of 'suck it and see' monitoring, and taking remedial action as soon as you see any sign that things are going wrong," Mr Hill says. "What you have got to do is the best you can with what you have, identify the gaps and seek to fill them. In the meantime, try to act cautiously so that you don't take any step that is irretrievable, if possible."

At Uluru/Kata Tjuta National Park, western park management techniques and the principles of traditional Aboriginal ownership of the land are intertwined in a way that the ANPWS believes serves as a model for co-operative management systems. A management guide prepared by the ANPWS says that western thinking tries to balance limiting the ecological impact of tourists with seeking to enhance the visitors' enjoyment. The Anangu traditional owners, however, must look after the country in traditional ways. "One of the challenges being met at Uluru National Park is the development of strategies by which traditional and western concepts of land management can be brought together," the document says.

Part of the process is to involve Anangu people in park decision-making and its day-to-day operations. The 11-member board of management has six Anangu members, and more than 30 Anangu work full-time or part-time in the park. Anangu people took part in the drafting of a 1986 Plan of Management for the park, shortly after freehold title to the Uluru and Kata Tjuta lands was handed back to the traditional owners by the Australian Government.

Aboriginal women also play a limited part in the tourism industry at Uluru, leading a walk (the Liru walk) which demonstrates traditional use of bush materials and discusses tjukurpa, the Aboriginal law which explains the origins of life, living things and the landscape.

Tourism has already made a significant impact on the park's ecology. The climbing path to the summit of Uluru appears shiny from a distance, the rock having been worn away by countless pairs of feet, and wheel-tracks believed to have been left more than 10 years ago by off-road drivers can still clearly be seen. Heavy penal-

ties are imposed on visitors straying from access roads or removing rocks and stones from the park.

Although recognising examples of successful Aboriginal involvement in sustainable tourism, the ESD working group has reservations about future prospects, although the report of the Royal Commission into Aboriginal deaths in custody identified tourism as a potentially major source of economic growth for Aboriginal communities.

The group says many communities have unrealistic expectations of the economic benefits, and there is at times a lack of understanding of the environmental or socio-cultural costs needed to achieve commercial success. The trick, it says, is to juggle commercial success, the resilience of cultural integrity and social cohesion, and maintenance of the physical environment, noting: "The impact of tourism on the natural environment is often linked to concerns about Aboriginal heritage protection with respect to sites of religious, historical and archaeological significance."

National parks present a particular problem for the tourism industry. ANPWS deputy director Mike Hill points to a polarisation of views about national parks and tourism. "You have got the very strong green element that says the place is just there to protect the beasties and you should not allow tourism or development of any sort, and you have got the tourism industry which sees national parks as being a prime resource for them."

"Whether you like it or not, the charter of national parks provides for the conservation of natural resources of the area while allowing for some form of access and use by visitors. You have really got to have a different recipe for different situations. Some areas can absorb quite large numbers of visitors, others can only cope with very small numbers."

The Wilderness Society believes tourism in wilderness areas must be limited to self-reliant recreation, specifically non-mechanised activities such as walking, climbing, rafting and canoeing. But it

The threat of feet

Sheer weight of numbers continues to pose the risk of ecological damage to unique sites in Australia. In 1990, Bureau of Tourism Research forecast that overseas visitor arrivals in Australia would increase at an average annual rate of seven to eight per cent during the decade, to reach about 4.8 million by the year 2000.

Overseas visitor arrivals totalled 2,214,000 in 1990. By 1995, the bureau estimates there will be 3,332,000 arrivals. Its forecast for 2000 is 4,847,000. This compares with a forecast by Qantas of 5.7 million arrivals by 2000, and a marketing target of 6.5 million by the Australian Tourist Commission.

The bureau predicts domestic tourism will increase at an average annual rate of two to three per cent until the turn of the century, with domestic visitor nights reaching between 270 million and 300 million by 2000.

Kakadu National Park

Vandalism has been a continuing problem, with at least nine incidents recorded in the past five years. The three Paintings at Maclean's rock art site, the only Aboriginal rock art in the blue pigment, were defaced by spray-painted graffiti. Several paintings in the Uluru rock shelter were destroyed by a visitor believed to have used a dampened cloth, although some were able to be restored without the addition of new paint. As well, stone artefacts have been taken from some sites. Damage caused by aircraft and helicopter has led to the introduction of new flight and access restrictions. Four-wheel drive vehicles may have inadvertently introduced weeds to the park. Vehicle tracks have caused substantial erosion, as has boat use on Kakadu river and billabongs. Conservationists fear that as original attractions become more heavily

Alpine regions

Damage from four-wheel drive access, now heavily restricted in winter months, and from bushwalking or trail-riding, which also have strict limits imposed. Slow-growing alpine vegetation is slow to recover from compacting and physical damage caused by bushwalking and camping. Alpine soils are shallow and highly susceptible to erosion and slumping. Walking is recognised as a major environmental hazard to alpine areas, even at low levels of visitation. Construction of facilities may cause erosion of topsoil, contamination of waterways, loss of habitat and migration of species.

ANDREW CHAPMAN / PACIFIC EYE

recognises that even this minimum-impact tourism may damage the environment. "In some areas – certainly in southwest Tasmania and Wilson's Promontory – there have been attempts to limit the number of people who go in there using those means through permit systems," says national forests campaigner Ms Georgia Stewart. In the Wilderness Society's view, environmental impact must be constantly monitored and restrictions on access implemented if necessary.

Ms Stewart said areas most at risk included Queensland coastal regions, the Great Barrier Reef, Cape York and the Kimberley. The reef was threatened by siltation from coastal developments such as the Daintree road, as well as pollution from boats illegally dumping sewage and waste products, and people directly interfering with coral habitats, while Cape York and the Kimberley were suffering from unrestricted vehicle use.

The WWF sees value in a graded system of access, along the lines of that adopted for the Great Barrier Reef Marine Park. On the reef, some areas are quarantined for scientific purposes, with prohibition of any activity that might damage an ecosystem used as a model for research.

A discussion paper issued by the Tasmanian branch of the Wilderness Society in 1988 suggested that tourism development should be concentrated on the periphery of natural areas, and be discouraged in core wilderness regions. It said development of all kinds, including interpretation facilities, should be confined to nodes and corridors where infrastructure already existed.

"Tourism has the ability to encourage hundreds of thousands of people to take a more caring approach to the natural environment. It also has the ability, like any industry, to simply see wilderness as a resource to be appropriated for corporate profit irrespective of environmental impacts.

"Nature tourism should place its emphasis not on a sanitised or technological encapsulation of the environment, but on a direct interaction with the natural world. The life of the natural world is not felt through technological gimmicks such as cable cars, helicopters and jetboats, but through nature on its terms – the antithesis of the technological world."

In Tasmania, some ecological impact of mass tourism has been recognised and acted upon. Cruise boats from Strahan on the island's west coast are now only allowed to travel about seven kilometres upstream on the Gordon River and have had their speed severely restricted because of erosion of the river's banks. Float-planes are now the only way for most tourists to see the upper reaches of the river.

Author Leigh Hemmings addresses the fundamental riddle of ecologically sustainable tourism in his book *Explore Australia's Wilderness*. "Publicity often increases people's desire to experience a wilderness area and greater use increases pressure on its resources. At the same time, publicity can alert people to the value of wilderness, as shown by the snowballing force behind struggles to protect the Great Barrier Reef, Coolool National Park and the Franklin River."

One artificial solution that has been identified is the establishment of replica ecosystems, such as at the Orbost Rainforest Centre in Victoria, a co-operative development by the Federal and Victorian governments which recreates a temperate rainforest habitat; another partial answer applied increasingly often around Australia is to construct visitor access walkways through limited sections of environmentally sensitive areas.

What is certain is that the economically crucial tourism industry faces the 21st century performing an extraordinarily difficult balancing act. The price of failure may be self-destruction.

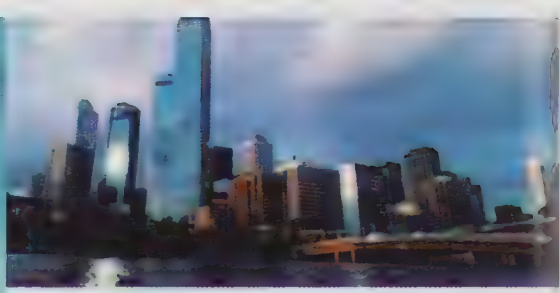

Gary Walsh is a freelance travel writer.

visited, pressure will increase for new attractions to be developed in more remote and ecologically sensitive areas.

Visitor numbers	
1982	45,600
1985	101,600
1990	229,000
1991	230,000

This represents an increase of more than 500 per cent in nine years, with an average annual growth of around 24 per cent. Since 1987, the trend has been towards a levelling of the growth rate. Visitation is highly seasonal: 86 per cent visit between May and October, with half of Kakadu's visitors arriving in June. July is August, and 20 per cent of the total annual figure arriving in July. Forecasts have not been made although the latest figures suggest visitation is down about 15 per cent in 1991.

Source: National Parks and Wildlife Service



Radio with vision...

Australians do have a voice, they can be passionate, they are capable of original thought, they are not, as is often claimed, apathetic and lazy. If you want evidence of this simply twist your radio dial until you find a Public Radio station.

On Public Radio you listen to the 'real' voice of Australia, maybe not the smart, polished banter you hear between ads on the commercial stations or the trained professional voices of the National Broadcaster. But real Australians. And it can be 'real' interesting.

Public Radio is providing a true alternative. Not recipients of the multi-digit income of the commercial broadcaster, the people presenting programmes on Public radio have complete creative freedom. Because by giving their time freely they are not constrained by politics sponsors, market forces or conservative management. They care passionately about what they do, they mean what they say and what's more they do it for nothing.

In the last decade the excitement and relevance of radio seemed to be gradually switching to public radio bands. **TRRR** with the biggest listening audience of any Public Radio station in Australia, has a tight, intelligent format of entertainment music and talk.

Clearly, **TRRR** is meeting and respecting the needs of their ever increasing audience which now numbers well over half a million.

TRRR's audience is not simply loyal, they contribute. Over 10,000 subscribers are willing to pay for the service which is offered free.

Commercial Radio Managements, alarmed by the erosion of their audience share, desperate to win the, now daily, 'ratings war', throw more and more money at 'on air personalities' rather than developing individual and creative formats.

The result for Australian commercial radio is sadly that talk-back speaks with one voice feeding from, and constantly repeating, the top news stories of the day, while music play lists are limited, repetitive and conservative.

It would serve both the good and the moribund of these managements, and those about to make the quantum leap into the field of Pay-TV, with their increasing army of accountants, to read the following:

1. Provide broadcasts in response to the particular and general needs of the community as determined by that community recognising an obligation to the needs of those denied effective access to, and those not adequately served by, other media.
2. Provide for active participation by that community in its management, development and operations.
3. Adopt a programming and management policy which opposes and breaks down all forms of discrimination.

These three points would seem to embody all elements to create exciting, entertaining, controversial and relevant broadcasting. As it happens, they do. They are three of the objects of the Public Broadcasting Sector.

No wonder audiences are turning their dials to **TRRR** and the Public Broadcasters around Australia. They are broadcasting with passion and honesty and genuine respect for the intelligence of their listeners. They are alive.

COLOUR



102.7 FM
THREE
TRRR

➡ Snap fast: Electronic photographs transmitted by telephone gave the US an edge in the Gulf War

AUSTRAL INTERNATIONAL

LIFESPAN

CLICK. The Box Brownie captures the today scene. **CLICK.** The Nikon snaps the happy couple. **CLICK.** Permanent memories. But a photographic revolution is about to sweep all that away. And the issue is: Can we believe our own eyes any more?

BY MARGOT O'NEILL

PHOTOGRAPHY'S

SNAP REVOLUTION



On the frontlines of the Gulf War earlier this year, little-known American combat units demonstrated a stunning technological revolution that will resonate from the sands of Kuwait to suburban homes around the world. While media attention focussed on the black magic of the Pentagon's Cruise missiles and "smart" bombs, the US Joint Combat Camera Teams quietly relayed thousands of photographs back to Washington with almost the same lightning speed as a television broadcast.

There were no rolls of camera film or darkrooms drenched in chemicals. There did not even have to be hard-copy prints. These were electronic photographs, images captured by tiny sensors in still video cameras transmitted via telephone or satellite to computers in the Pentagon. The entire process from when the combat teams shot a picture to its analysis in Washington could take mere minutes.

"If Vietnam was the first 'live' television war, then the Gulf campaign produced the first victory for wartime electronic still photography," said Alfred deBat, an ex-Army officer now with the umbrella association, Professional Photographers of America. And none of it is secret. All the equipment was off-the-shelf, products made by Canon, Kodak, Nikon and Sony. Any corporate photo department could purchase it today. Many already have. The long-term picture is still blurred but photography is moving out of the darkroom and onto desktop computers, where it is poised to shake up the traditional family album and convulse an industry which still relies on the same kind of chemical-based procedure unveiled by the French inventor Jacques Daguerre in 1839.

While electronic photography is still largely cloistered in military and professional applications such as advertising, it holds spectacular potential for the consumer market. A still video camera looks like an overweight 35mm film camera but instead of being loaded with film, the camera back opens to accept a 2-inch

floppy diskette. Built into the camera is a scanner chip called a charge-coupled device (CCD) that senses colour and light and converts images into a video signal. The viewfinder is a tiny TV screen that shows what the scanner is seeing. The shutter button is a contact switch that sets the internal disk drive to record.

There are also various extras for image reproduction. Video transceivers convert the picture information on disk to digital data and transmit it via telephone or satellite, just like a computer modem, and just as the Pentagon did during the Gulf War.

Video players convert the data to regular outlets on television or video tape recorders so the photographs can be viewed on a big screen. Video capture products translate the still images into computer files that can be edited and manipulated. Video printers take the disk and print out a colour image to paper just like a photo print. In essence, electronic photography offers shutterbugs two seemingly irresistible advantages: speed and boundless creative possibilities to crop, enlarge, enhance or combine their own photographs.

Consider the annual Christmas snapshot. A family could download it into a television or computer for instant viewing then manipulate the image to enhance colour and lighting, and much more. They could edit out a distracting plant obscuring a family member. They could remove unsightly skin blemishes from the teenagers, grey hairs from the parents, bleary eyes and food stains from the over-indulgent uncle before blowing it up and printing out multiple copies for everyone to take home.

"I could give you any hairstyle you want," says Arthur Diamond, who runs a Californian photography consulting firm, Diamond Research Corporation. "I could change the fabric you are wearing. I could change your race." If you miss the football team photograph, another picture of you could be cropped and realistically merged with the team's portrait.

Don Barlow, who works with Kodak's electronic imaging systems, says the new technology offers many poignant opportuni-

Soon techniques used for advertising – like this chocolate drop – will be used in every home



ties. He combined a photograph of his young son with a childhood picture of himself. "It is a very emotional shot. Me as a six-year-old standing with my own child who is six years old. Other people may want to create combination portraits with deceased family members."

The mass popularisation of such options could spawn what Arthur Diamond calls an explosion in colour artwork. Consumers will be able to manipulate their own pictures or the photographs of others and add text to create personalised greeting cards, large-size colour posters, T-shirts, coffee mugs and other novelties.

"I believe that by the year 2000 we'll be surrounded by colour images at home, in the office, in our shops and other public places. Digital imaging and non-photographic processes will make colour affordable and accessible to everyone," he says. The signs of this new "business within a business" have already begun to emerge. Last year the chief executive of Microsoft Corporation, William Gates, started bidding for electronic rights to thousands of well-known paintings and photographs. No one knows what Mr Gates intends to do with these pixels (the tiny dots that make up an image) but the market potential is clear.

Mr Diamond says he has seen paintings photographed and reproduced with enhanced colours and clarity. Art buffs will cringe but Mr Diamond says that they "look better than the original." "It is likely our walls will be hung with family portraits, beautiful landscapes and the world's art treasures, scanned, digitised and reproduced with breathtaking clarity, colossal in size and vibrant in colour," he says.

The possibilities are staggering. What consumers decide to include in a poster or memento would simply depend on their imagination – or sense of humour. "Someone might decide to give his ex-wife a third eye or position friends in front of bizarre scenery," says Don Barlow. They could combine their own picture with that of the Mona Lisa. Or dining out with George Bush, Elizabeth Taylor or dancing with Madonna.

Home art: Robyn Stacey's techniques will be available to many

Because of the obvious market potential Mr Diamond predicts that celebrities will sell their pixels in computer file format "probably to a commercial business in a shopping mall." It will impact on hundreds of businesses, from geophysical exploration to real estate to architectural planning. The British Ordnance Society is considering a "Dial-a-map" service where attendants at petrol stations would print out road maps on demand from a master file stored on an optical disc.

For those with home computers there are increasingly sophisticated software packages to modify an image without requiring an artist. Photoshop by Adobe is one of the most popular and powerful. It offers 16 million different colours for image enhancement.

In the not too distant future, consumers may also be able to try on clothes via their home computer by downloading electronic photographs from a store's catalogue and variously combining them with a self-portrait. Interior designers could show how they would redecorate a house by similarly combining and manipulating electronic photographs.

If all of this sounds improbable, consider some of the consumer products already in the pipeline. Kodak has a compact disc which will store up to 100 photographs to be viewed on television; Hitachi has a printer which converts images from home videos into hard-copy photographs. But the electronic revolution has a long way to go before it displaces conventional photography, for one key reason: image quality. Electronic cameras have been on the market since the early '80s, but while the camcorder home video took consumers by storm, still cameras flopped.

So far, electronic cameras have not been able to match the resolution of conventional film which can capture up to 80 million pixels per image. The best electronic sensors can only capture up to 1.3 million pixels. But if it lags behind in image capture, electronic photography is sprinting ahead in image reproduction.

Meeting the Challenge of



Jonathan Pinshaw,
Managing Director, Hanimex
Australia & New Zealand.

How does an Australian-based company become a world leader in photography? We talk to Hanimex's Australian and New Zealand Chief Executive Officer, Jonathan Pinshaw.

RIGHT:

Ultra modern styling and advanced features are the hall-marks of the Fuji FZ 3000 Zoom Date recently unveiled by Hanimex in Australia. A built-in three times zoom lens covers from 38mm wide to 115mm telephoto. In addition, the zoom lens allows macro shooting as close as 0.8m from the subject. The colour rendition is superb and the f/4.4-f/8.9 13 element lens yields crisp, big enlargements. The FZ-3000 Zoom Date uses Fuji's famous drop-in, pre-wind, loading system. All the user has to do is simply drop the film in the camera. As soon as the back is closed, the film automatically winds to the last frame. As the pictures are shot, the film then winds back into the light proof canister. This way, the pictures taken are immediately protected against any accidental opening of the camera. Simple, but effective.

For nearly half of this century of tremendous technological advancement, an Australian company has been quietly playing a leading world role in the evolution of photography. From its Brookvale headquarters on Sydney's beach-lined north shore, Hanimex designs for slide projectors, cameras and photographic accessories have won favour with photo enthusiasts in 65 countries.

Over the years, the company established a network of offices, distribution centres and manufacturing facilities in Europe, the Americas and the Far East. In 1985, the Australian company took another big step forward with the total purchase of the highly respected Vivitar Corporation headquartered in America.

But this golden era of growth has not been without problems. The rapid technical evolution of photography has created a marketing minefield laid in quicksand. Cameras have been plucked out of the few hands of the dedicated photo enthusiasts and popped into those of vast millions of adults and children casually clicking away as a part of their everyday lives.

Large numbers of enlargers,

projectors, fancy flash guns, lens-filled gadgets bags, and all the other paraphernalia of the photographic elite, are now moulding away in attics all over Australia. In their stead is a new generation of camera users, delighted with the simple automation of modern compact cameras. Beautiful colour pictures at the simple press of a button. All easily and inexpensively processed at the local minilab.

The change was rapid. Unfortunately, there were famous international names in photographic manufacturing that were not quick enough to recognise the shifting grounds. Once famous camera brands such as Exakta, Topcon and Graflex now seem gone for ever.

Hanimex has not only survived, but prospered. It has switched from being primarily a relatively slow and cumbersome manufacturer to a fast moving international marketing and distribution company. Hanimex uses its long photographic experience to design and have built well featured value for money products that are in demand throughout the world.

Piloting Hanimex through this period of fast-changing consumer demand is Jonathan Pinshaw, the young and energetic chief executive officer for Hanimex operations in Australia and New Zealand.

Said Jonathan Pinshaw: "Meeting change on a personal basis can be extremely difficult. But for a company, it is far harder than that. For us, it is not just a question of meeting changes early. We have to be able to anticipate the changes.

"We have to be able to offer the right products, at the right prices and at the right time. That doesn't mean staying abreast of the market. You have to be ahead of it. But that is only the starting point. Apart from the technological changes, there has been a major change in consumer attitudes. Customer

expectations for service are now very high. And very real. So when we say service, we cannot mean mere lip service.

"This is a major cultural change. We have to go from the 'she'll be right mate' attitude to a deep and true commitment to excellence. At Hanimex, we are focusing our energies on this concept."

Many of the changes to worldwide picture-taking have stemmed from Japan. This itself has been a switch away from the previous dominance of the camera manufacturing scene by Germany. Hanimex did indeed pick this swing at a very early stage

and forged a strong relationship with the Japanese giant Fuji company while it was still at international fledgling stage. Together,

Hanimex and Fuji have developed business in Australia to the stage where Fuji's market share presentation has become one of the highest in the world.

"Much of our success," says Jonathan Pinshaw, "must be attributed to the tremendous advances made in photography by Fuji. The company is at the very forefront of new photographic technology on all fronts.

"On the film front, in the last 12 months or so, we have seen the introduction of international award winning films such as Fuji Velvia and Realta. These have been proclaimed 'the best' by photographic experts around the world.

"On the camera side, Fuji has pursued opposite ends of the spectrum. At one end is the new stylish and totally automatic Fuji FZ-3000 Zoom Date. Looking more like a pair of binoculars than a conventional camera, it can do all the things that previously required a hideously expensive, large, cumbersome gadget bag of photographic products. This camera has all these things built-in: zoom, macrophotography, flash you name it.



Change

"At the other end of the spectrum, Fuji has been developing one-use cameras that allow anyone to buy a camera and take a picture."

Launched by Fuji five years ago, the concept is rapidly gaining in popularity both here and overseas. This year worldwide sales of one-use cameras are expected to grow by 25 per cent to reach a staggering 30 million units.

One-use cameras have become a life saver for tourists who have forgotten their cameras. Also youngsters can develop their creativity without risking a valuable possession. And there are many older people with only occasional picture-taking needs who prefer them to the alternative of investing in and caring for a modern camera.

They are extremely inexpensive to buy. A 24-exposure model with the film built-in costs about \$10. While you only use the camera once, you keep the memories for ever.

Hanimex and Fuji are taking the environmental issue very seriously. Said Jonathan Pinshaw: "We do not believe it's just a media-blown hobby horse for a few fad Greenies. It is a real, broad-based, key issue of the '90s."

As far back as 1983, Fuji founded a special Green Fund to preserve nature with a 1 billion yen donation. It was one of the first companies in Japan to plan its corporate activities to conserve resources and save energy by making use of specialised personnel and technologies.

Naturally, at the manufacturing end, the handling of chemistry is a very serious matter. The solutions are highly concentrated and handled in huge volumes which require extreme care.

Fuji's Ashigara factory has become a model for other manufacturing facilities throughout the world. Its air and water recycling and purification system is extremely sophisticated. The company has an almost unbelievably strict policy. No chemical waste leaves the plant at all until the effluent is clean enough to keep fish alive. To prove the point, 20,000 lively carp swim around in the final reservoir.

But photofinishing methods have also greatly changed in Australia. At the beginning of the '80s more than 75 per cent of the Australian photo finishing business was funnelled through just four national processing laboratories.

Says Jonathan Pinshaw: "Now over 70 per cent of all developing and printing is being handled by on-site minilabs. The side-effect of this has been that waste disposal has to be handled on a local basis.

"The photographic industry has been quick to respond to this. We have worked collectively with water boards around Australia to ensure that photo processing is done in a safe and friendly way for the environment.

"There was an urgent need for the industry to develop photo processing systems that reduce wastes to the lowest possible levels. Fuji has now developed low-effluent type photo processing systems consisting of several new types of chemicals that require lower replenishment and a unique rinse cleaning system that prolongs the life of rinse water through rejuvenation and reverse osmosis.

"The result is that we are producing considerably safer and cleaner chemistries than in days of old."

But how much of a challenge is electronic picture-taking making to photography? Is the writing on the wall for companies in the photographic business?

"Well," says Jonathan Pinshaw, "firstly we do not consider ourselves to be merely in photography. Hanimex is in the imaging business. And whether silver halide or magnetic tape is used is not a major issue for us. Also, many of our products are in the medical, commercial and scientific fields.

"And as far back as 1985, Fuji started producing video camera equipment. Indeed, Fuji has just pioneered a new system where photos of the future will be stored on special magnetic memory cards.

"These cards allow colour snaps to be viewed on home television sets, stored on compact discs, transmitted by

phone, or made into full quality photographic prints."

The Fujix DS-IP, launched in 1988, was the world's first electronic camera to record images as digital signals on a memory card and is capable of giving high-quality prints through an especially designed video graphic print system. Newly developed dyes have dramatically improved the colour reproduction of other video printers.

A special computer program also allows the image to be manipulated. Changes such as turning a woman's dress from red to green, or even raising or lowering the hem, can be done with manipulation on a special digital image processor.

But Jonathan Pinshaw sees still magnetic imaging as having little impact upon the main consumer photographic market for some time to come.

"While there is no doubt that Fuji has pioneered some fascinating advances in electronic image making, conventional photography still goes mainly unchallenged. The main applications for electronic still-imaging spring from magnetic imaging's large-volume image filing and retrieval capabilities. This make it more the province of businesses, car dealers, real estate agents, libraries and museums," says Jonathan Pinshaw.

"Modern cameras have become less expensive and easier to use. The quality and cheapness of modern colour films and prints will keep conventional photography the most popular choice for some considerable time."

How-so-ever and where-so-ever photography may continue its rapid development, one thing seems certain to remain unchanged. And that is the ability of Hanimex to meet that change. Hanimex is most undoubtedly a company with a future and for the future.

The Fuji Quicksnap camera is a one use camera bringing picture taking within the reach of all. You might only use the camera once, but you keep the memories for ever.



ABOVE:

The photos of the future will be stored on special magnetic memory cards according to a new system unveiled by Fuji. The system allows colour snaps to be viewed on home television sets, stored on compact discs, transmitted by phone, or made into full quality photographic prints.



The Fuji Quicksnap camera is a one use camera bringing picture-taking within the reach of all. You might only use the camera once, but you keep the memories for ever.



The availability of street corner processing has been a major advance. The new Fuji Minilab FP560B FA uses newly developed fast access processing chemistry to give a dry-to-dry time of only 8 minutes 15 seconds- cutting over five and half more minutes off the time of conventional processing. Chemical waste is also reduced to minimal levels.

BOOK OF



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COLOURS

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*why hath thy queen
Summon'd me hither*

Arthur Diamond believes that by the year 2000, it will have captured up to 70 per cent of the colour print retail market.

"The electronic still camera might be a distant reality to the camera-carrying consumer, but digital scanners and digital colour printers are here, now, in abundance at affordable prices." In part, the evolution will be driven by environmental concerns as much as economic ones. Every amateur darkroom, commercial studio and photo-processing store is increasingly seen as a potential source of effluent chemicals. Electronic image processing, on the other hand, is relatively pollution-free. Thus most industry giants like Kodak and Fuji are working on hybrid technology to marry conventional film image capture with electronic image reproduction.

Kodak's Photo CD Player is a good example. Customers will have the choice of taking home traditional prints and/or a compact disc which can hold up to 100 photographs and which can be brought back to the store for add-on pictures in what amounts to a magnetic photo library. It will become the "electronic picture album of the future" according to Diamond, "replacing the unmanageable mess of negatives and prints that many of us have buried in boxes and files." Developed with Philips, the Photo CD Player will play both Photo CDs and audio CDs and will be compatible with television systems worldwide.

"We expect Photo CD will bring the same benefits to photography that audio CD has brought to music," said Peter Palermo, Kodak vice president and general manager of the Consuming Image Division. "High-quality digitised images that can be called up at random and manipulated will change the way people think about pictures."

Where consumers do not want to invest in their own CD

player, Kodak hopes that photo-processing stores will invest in equipment enabling on-site viewing. Because of the expense of much of the new technology, few people will be able to afford their own product enhancement equipment. So stores are likely to expand their services to include on-site viewing on television monitors as well as personalised editing, cropping, enlargement and enhancement.

Among those who might invest (besides the Pentagon) could be law enforcement agencies. The speed of electronic transmission means, for instance, that a robber can be photographed by a store or bank video camera which can relay the image to a police station virtually instantaneously. Before the robber could mask his getaway, his picture could be relayed to monitors in police cars near the scene including a positive identification, if he has prior convictions.

Similarly, medical centres could slash time-consuming laboratory tests by converting a tissue sample into an electronic image, manipulating it to highlight cell structure and cross-referencing the image with a computer library which would automatically spit out a diagnosis.

There is one professional field, however, where increasing concern has been expressed about the new technology: photo-journalism. While advertisers and graphic artists have delighted in the fantasies they can create with electronic imaging, some critics point to troubling image manipulation by news outlets. The attraction of the instant transmission of electronic pictures is clear for the media: instead of running a front page photograph from midway through a football final, newspapers can now squeeze in the final winning goal.

But the ever more sophisticated software attached to elec-

Peter Greenaway's film *Prospero's Books* is pioneering tomorrow's television paintbox

A CHRONOLOGY OF IMAGING PROCESSES

THE AGE OF PHOTOGRAPHY

- 1802:** Thomas Wedgwood creates an image on paper coated with silver nitrate.
- 1816:** Joseph Niepce forms an image in a camera on sensitised paper.
- 1835:** William Henry Fox Talbot invents the negative-positive process of photography using silver chloride salts in place of silver nitrate.
- 1839:** Jacques Daguerre invents the daguerrotype process using a copper plate coated with silver, sensitised by iodine vapour.
- 1842:** Sir John Herschel invents the blueprint process, using iron salts.
- 1851:** Glass plates first used in a camera, gelatin emulsion pioneered.
- 1888:** George Eastman introduces roll film,

putting photography into the hands of the masses.

1890: British scientists Green, Cross and Bevan invent the diazo image transfer process. (The diazotype process is widely used for engineering and architectural drawings. It replaced blueprinting because it is dry, simple and inexpensive).

THE AGE OF REPROGRAPHY

- 1917:** First diazo paper produced in Germany.
- 1923:** Diazo process marketed in Germany and the US.
- 1938:** Electrophotographic process invented using plain paper.
- 1950:** First commercial thermographic office copier. Haloid-Xerox commercialises first xerographic equipment.
- 1954:** RCA scientists invent "Electrofax" process using zinc oxide coated paper.

1959: Xerox introduces first automated copying machine.

1961: First dry Electrofax copier introduced.

1967: NCR, Texas Instruments develop first page-wide thermal imaging printhead.

1970: Ink jet printers for data processing and telecommunications go on sale.

1975: Japan begins to penetrate US office copier market.

1980s: Personal computers and low-cost laser printers enable desktop publishing; direct thermal facsimile revolutionises business communication; colour imaging systems become commercial, based upon thermal, ink jet and toner-related processes.

THE AGE OF ELECTRONIC IMAGING

1990s: Direct digital colour printing by thermal, ink jet and electrostatic methods enables rapid, low cost high quality colour

reproduction, for applications that include graphic arts, advertising, signage, photo posters, medical purposes. By the turn of the century, automated colour printing machines should convert most retail photofinishing to electronic imaging processes: thermal, ink jet or toner-related.

2000s: Electronic image capture using ultra-high resolution video cameras that enable acceptable colour prints via freeze-frame imaging.

THE AGE OF EXTRA-SENSORY IMAGING

2000-plus: New sensors – possibly bionic – enable the capture of extra-sensory signals and their conversion into visible images, the capture of signals from deep space. The discovery of new energy forms leads to new methods of imaging.

COMPILED BY ARTHUR DIAMOND

tronic imaging means dummy pictures are now virtually undetectable. It is all very well to create a photograph of yourself with your favourite rock artist, but what about when a magazine like *National Geographic* moves one of the Egyptian pyramids to provide a better cover shot? (It did just that in 1982).

In news coverage and often in court cases, the traditional adage has been that "Pictures don't lie." But photographs may no longer seem as real as they once did – rather like athletes on steroids. Readers of newspapers and magazines could come to view news pictures more as illustrations than reportage because they know they can no longer distinguish between a genuine image and one that has been manipulated.

According to Fred Ritchin, the author of *In Our Own Image: The Coming Revolution in Photography*, it is impossible to tell whether an electronic image comes directly from a camera or is enhanced by a computer. "If an editor or production person alters the image en route to the printer, and the photographer records over the original image, then it is virtually impossible to prove the image was changed or even the fact that it was retouched."

The conundrum is exacerbated because magnetic storage disks used by still video cameras are "made to be used again, and each image can be individually erased and recorded over (so) there is no equivalent to an original, archivally permanent negative." The ramifications could be significant. Does a court room jury continue to trust photographic evidence? What would have happened to Kurt Waldheim, the Austrian President, who continued to deny his Nazi links until presented with photographic proof? Future Waldheims may plausibly claim they had been compromised by a computer.

The photographic industry is also suffering an identity crisis because of the electronic revolution, especially Kodak and Polaroid

which have built their empires based on traditional chemical-based photography. They will be increasingly pitted against the electronic wizards at Sony and Hitachi.

Kodak chairman Kay Whitmore has conceded that "the basic electronics battle was lost 20 years ago. The opportunity for Eastman Kodak to be a full-line electronics company is gone." Kodak's core film and photographic supply business and specialty chemicals subsidiary are still the company's big moneyspinners. Its information segment, where Kodak's copier and computer-oriented businesses are concentrated, is earning a paltry \$5 million.

The company believes it can remain a domineering force into the next century through a partnership between chemical and electronic technologies such as its Photo CD. But it is likely to be a fiercely competitive battle with high product burnout and turnover.

When Arthur Diamond speculates on where photography may end up in 40 years he predicts that all still cameras, whether electronic or film, will be "museum pieces." "No matter how many shots you take, still photography can miss the action, miss the one moment. Video does not. But the problem with that is when you freeze the frame, the quality is too poor for a single print. That will change as the technology improves. The next big revolution will be when video cameras can provide the same high resolution on a freeze frame as photography."

Beyond that he wonders whether it may be possible for cameras to ultimately photograph what the eye cannot see. "I'm fantasizing I know, but maybe we will be able to photograph things like personal auras, or even prove supernatural effects, or capture impulses in space."

Margot O'Neill is an Australian journalist based in Washington



The Super S

Vast numbers of ageing baby boomers will totter into retirement next century, imposing an extra burden on a system already under stress. How will Australia support them? Singapore may show the way.

AN AUSTRALIAN COMMISSION FOR THE FUTURE RESEARCH REPORT

If the key to funding Australia's future retirement incomes policy is superannuation, then the motivation to turn the key is to be found in Singapore. For years, the island-state has successfully made its fully funded national superannuation scheme the basis for its retirement incomes policy. People who doubt that Australia's traditional age and service pension can be replaced need only examine Singapore's remarkable experience.

The Central Provident Fund is much more than just an alternative to the pension: it has many other benefits, both national and personal. Through it, Singapore's gross national savings have been boosted significantly, and members are also able to use contributions to buy homes and pay for hospital visits.

Singapore does not have, nor does it appear to need (at least while low rates of unemployment continue) a social security system to provide retirement incomes. That is being done through savings and investment income built up by the CPF. The Singapore community benefits twice: first, from a healthy and rapidly growing economy and second, from knowing that there is a pool of savings to fund retirement incomes.

THE TWO SYSTEMS COMPARED:

Under the Singapore system, it is compulsory to provide for your retirement through employer and employee contributions to the CPF. Established by the central government in 1956, the CPF began with 12,900



TODD DAVIDSON

uper Scheme

employers and 180,000 members, and savings of S\$9 million. Today, membership is 2.2 million with 82,430 employers making contributions and savings of S\$43 billion.

The CPF's impact on gross national savings is considerable. Annual contributions now constitute 25 per cent of total savings and have contributed in a significant way to Singapore's major savings effort over 20 years. As Table 1 highlights, Singapore certainly does not suffer from a shortage of domestic savings in the way that Australia does.

As with Australian superannuation arrangements, the CPF uses the individual as the basic contribution units, but unlike Australia, there are considerable incentives for members of a family unit to assist each other. A CPF member normally holds three accounts with the CPF Board: an Ordinary, a Medisave and a Special Account. On reaching the age of 55, a member is also required to open a Retirement Account as part of the arrangements requiring each individual to keep a Minimum Sum available to provide a retirement income.

Perhaps the most striking differences from Australian superannuation arrangements are to be found in the rules that allow Ordinary Account savings to be used for housing, approved investments, insurance and transfers to top-up parents' Retirement Accounts. Medisave Account savings are for meeting hospital expenses while the Special Account is reserved for old age and contingency purposes. Money not

used directly by individuals for approved purposes is invested in the Singapore economy and overseas assets.

Australia does not have one central superannuation fund established and controlled by government. Retirement savings are invested in a large number of separate superannuation funds including those sponsored by employers, life insurance companies and other financial institutions, unions and industry associations. Once invested, superannuation savings cannot be used for other purposes until paid out as final benefits. Australian savings are invested in a wide range of assets including bonds, debentures, property, shares and overseas assets.

The range of services that can be accessed using CPF contributions, primarily those built up in the Ordinary Accounts, are very wide. They include:

- up to 100 per cent of Ordinary Account savings can be withdrawn to pay the purchase price of a government flat;
- Ordinary Account savings can also be used to buy a private residential property;
- to purchase permanent disability or death insurance to guard against the loss of a home in these circumstances;
- to invest up to 40 per cent of their investable savings exceeding a minimum reserve of S\$32,700 in approved investments; and

- to buy shares in the Singapore Bus Service Ltd which offers concessionary fares to their shareholders.

The relevant CPF legislation contains safeguards to prevent abuse and to discourage speculation. For example, the proceeds from the sale of investments must be used to repay borrowings from the CPF and any accumulated CPF earnings that would have accrued on the borrowings during the period of the loan.

The Minimum Sum Scheme also assures CPF members of steady monthly stream of income from the age of 60 to help meet basic living expenses. Members must leave a minimum of S\$32,700 in retirement accounts to provide that minimum level of income. The Minimum Sum Scheme money can be withdrawn only as a regular monthly income, but all other savings can be taken as a lump sum benefit.

The current minimum monthly payment for a retiree over age 60 is S\$251 a month, adjusted annually for inflation. This amount is paid until the total balance in the account, including interest, is used up, at which time the individual concerned would have to draw upon other savings.

Apart from the very high contribution rates to the CPF during working life, the Australian system differs in many respects. There are, for example, no restrictions on Australians taking all their accumulated superannuation savings as a lump sum benefit at age 55 or later retirement. Anyone able to comply with the social security income and assets tests is able to obtain an age or service pension after reaching the relevant retirement age.

At present, a large percentage of Australians still reach retirement age with little or no accumulated savings. This will change as the coverage of superannuation spreads to all of the workforce and as the required level of employer contribution increases as proposed to 12 per



lowest income taxpayers to only 6 cents in the dollar compared with a maximum tax savings of 33 cents in the dollar to highest income taxpayers.

Clearly, Singapore has made a concerted effort via concessions and attractive arrangements allowing use of accumulated savings for designated investments before retirement to cushion the impact of the compulsory CPF contributions on ordinary Singaporeans. The existing and proposed new Australian arrangements, by comparison, provide no assistance to people of workforce age, allowing access to funds invested only at the time of retirement.

INTEGRATION WITH THE SOCIAL SECURITY SYSTEM:

Singapore has effectively used the CPF since its establishment as a replacement for a social security system for its retired population. Cov-

The Singapore experience demonstrates how a program a superannuation fund can be a very effective replacement

cent of salary in the year 2000. The August 1987 ABS employment benefits survey showed that only 2.3 million (39.9 per cent of total employees) received a superannuation benefit from their current employer, while today closer to 5 million employees are covered by superannuation awards.

Unlike the system in Singapore, which applies on a consistent basis to the whole population, Australian superannuation arrangements are also biased heavily in favour of men and government employees. The proportion of Australian males in the workforce covered by superannuation is twice that for females while more than 80 percent of public sector employees are covered by superannuation compared with a 55 per cent coverage in the private sector.

TAXATION ASPECTS:

Until the latest action to use the tax system to compel employers to make superannuation contributions for the employees, Australia had relied on generous tax concessions to encourage retirement savings via employer and other superannuation funds. Not surprisingly, given the high compulsory levels of contributions, Singapore also offers a generous tax concessions to contributions to the CPF.

Tax arrangements are similar in both countries, though paradoxically Singapore's tax regime offers more generous assistance. In Singapore, both employers and employees are entitled to tax deductions for their contributions to the CPF and the government levies no tax on these contributions or investment earnings in the fund.

Australia, by comparison, denies some individuals any tax deductions for their fund contributions and subjects all other contributions and fund earnings to a 15 per cent superannuation tax. The effect of this tax is to reduce the tax advantages from superannuation savings for

erage of the CPF is at very high levels because of continuing low levels of unemployment in Singapore. While unemployment remains low and CPF contribution and earning rates are high, Singapore will have no major need for a separate social security system to provide retirement incomes.

Gross National Savings as a Percentage of Gross Domestic Product Singapore and Australia

Year	Singapore % of GNP	Australia % of GNP
1970	19.3	26.1
1975	25.5	26.5
1980	28.4	22.1
1985	41.0	19.2
1990	44.6	22.2

TABLE 1

Its Minimum Sum Scheme effectively operates to provide a basic level of retirement support to the population. For Australia, however, the social security system will continue to play an important role for many decades yet and questions of the integration of superannuation and the age and service pensions will be of the utmost importance.

Australia has no Minimum Sum Scheme to ensure that the first part of an individual's superannuation benefit is used to provide a regular stream of income in retirement. Indeed, the design of the Australian system, with its exemption of the first \$73,776 of post-1983 benefits from tax, encourages retirees to withdraw their money on retirement.



Australia also applies no penalties to people who dissipate their superannuation benefits, for example by funding early retirement then claiming an age pension. While Singaporeans are encouraged to make house purchases during working life, using CPF contributions, some Australians utilise their superannuation benefits on retirement to pay off a house mortgage and/or upgrade their standard of housing and thereby increase their age or service pension entitlement.

The Singapore model is thus clearly relevant to future policy considerations of alternative approaches to integrate our social security and superannuation systems.

ROLE OF THE PRIVATE SECTOR:

It would not at this late stage be possible to establish one central government controlled entity such as the CPF to replace the present large

wholly or in part on social security financed out of current taxes for their future well-being and the unfunded nature of the major government employee superannuation schemes. The latest Australian action to force employers to contribute to superannuation could well be a case of too little too late.

By the year 2010, the ageing of the Australian population will be starting to reach its peak. Yet the Australian Government proposes only a 12 per cent of salary compulsory contribution to superannuation to apply from the year 2000. This timing will be too late to be of great assistance to many Australians.

Singapore has shown Australia how we can integrate the retirement savings objective with other key motives for saving. Until our system is changed, younger people may resent being forced to contribute to superannuation. In Australia, for tax and other reasons, paying off a house mortgage can be a better and safer investment than contributing to a superannuation fund.

Forced membership of an Australian superannuation fund merely to meet the Government's longer term objective of reducing the call made on the age pension many years in the future will exacerbate the current conflict with the achievement of home ownership. Forced superannuation membership could even result in the loss of the home if the combined cost of servicing the mortgage and the compulsory superannuation proved to be too much of a burden. Once the home is paid off, however, there are fewer obstacles to contributing to superannuation on a compulsory basis.

Singapore has also arranged to maximise its savings effort by marshalling individual as well as employer savings. Singapore has retained a major emphasis on contributions by employees and employers to the CPF. Australia, on the other hand, has announced government policy

of compulsory employer and employee contributions to in to the age and service pension in the next century.

number of superannuation funds in Australia, but the Singapore experience demonstrates how a program of compulsory employer and employee contributions to a superannuation fund can be a very effective replacement to the age and service pension in the next century. It would not be able to replace social security benefits for all people, especially while current high levels of unemployment remain. But a fully funded superannuation scheme can certainly provide retirement incomes to future generations of Australians.

The CPF has one more advantage over the private sector superannuation model in Australia: Singapore does not require the costly regulations and controls to ensure the safety and security of benefits. With a large number of funds, including some involving high fees and charges, the Australian Government will face major regulatory and control problems, especially when the 1991 policy changes requiring compulsory contributions are implemented.

What, for instance, will be the protection to individuals to guard against losses from bad investments or fraud and abuse by their relevant fund managers and trustees? Such a question is not even relevant in Singapore because of direct government involvement.

IMPLICATIONS FOR FUTURE AUSTRALIAN POLICY:

By comparison with Singapore, Australia is currently pursuing a high risk strategy with no guarantee that sufficient funds will be available to fund future calls on the age or service pension and other welfare benefits. The Australian Government's recent action to introduce compulsion into our superannuation system clearly addresses this problem.

Australia's policies contain key flaws which could well prejudice the future standard of living of our retirees as the population ages. These flaws include the large number of people who will continue to be reliant

as placing the funding burden totally on the employer, at least in the initial incidence of the burden.

The Singapore arrangements are also interesting in the treatment of the self-employed who, as in Australia, are only encouraged and not compelled to join the CPF. Indeed, self-employed people are given considerable freedom of action. They can claim tax deductions for life insurance contributions of up to S\$5000 if they do not make equivalent contributions to the CPF.

Of special interest is the absolute level of S\$6000 per month placed on the monthly salary eligible to make contributions to the CPF and a corresponding annual limit placed on the contributions of the self-employed. These levels are the cut off points for tax deductible contributions to the CPF.

The Australian superannuation system operates quite differently with the Reasonable Benefit Limits permitting older persons with high incomes to make substantial contributions, even in excess of their salary income, in one year. This ability of high income Australians to avoid substantial amounts of tax has concerned leading social welfare organisations, including the Australian Council of Social Service

Singapore has, most probably because of its comprehensive coverage, chosen to limit the annual contributions and the resulting costs of the tax concession to a reasonable maximum ceiling applicable to all individuals. Such an approach would be relevant to future Australian policy decisions.

A report entitled "SAVING FOR THE FUTURE - a comparative study of savings policies in Singapore and Australia" was commissioned by the Australian Commission for the Future Ltd. and prepared by Daryl Dixon and Georgina Carnegie. The report is available from the Australian Commission for the Future Ltd.





A DIVE INTO

DATALIFE

From a SF cyberdata fantasy,
to hotbed research at NASA,
to your home. Virtual Reality is
the high tech treat everyone
will want.

BY RICHARD SMITH

I could tell I was quite deep now. It was getting dark – an inky blue black stretched to the limit of my vision. I could still hear the ferry to Seattle passing above me though, and craned my head around just in time to see its hull slice through the icy waters of Puget Sound. The gear was pretty bulky and I was having trouble getting used to it. The view in my goggles



was a little blurry, but it was obvious the water was very clear. I could see my gloved hand floating before my eyes. But my thumb seemed to be stuck, and I was STILL going deeper.

What I was doing was really quite impossible—hundreds of metres below the surface in freezing cold water, moving (almost) where I pleased and reaching out to pat the odd passing whale. Well, I was and I wasn't. In reality, I was sitting bone-dry in a chair in a small windowless room in San Francisco. Seattle Harbour was locked up somewhere inside half-a-dozen boxes of nondescript computer equipment on a rack by the wall. Through a magical interplay of software and silicon chips, the computer was generating the sounds and images of a syn-

thetic world—a world that responded to my presence. When I turned my head, my viewpoint changed. When I moved, I moved in three dimensions. I had immersed myself, not in the real waters of Puget Sound, but in the digital depths of Virtual Reality. I was taking a dive into a data-set.

If you haven't heard about Virtual Reality (VR to its aficionados) you soon will. The predictions are that it will become the next big thing in the communications revolution: perhaps the biggest thing of all. It promises to finally deliver something we have been trying to achieve for centuries; to recreate a real or imaginary world for others to experience. We do this in books, in paintings, at the



cinema and on television. Virtual Reality takes the next step, allowing the user to enter and participate in whatever computer existence you desire to create.

"Cyberspace", "Artificial Reality", "Telepresence" are some of the alternative names used for these emerging synthetic worlds. "Virtual Reality", first coined by one of the technology's key players, Jaron Lanier, is the one that seems to have stuck. If your standard image of a computer whizz is a callow, bespectacled youth, more attached to the mains than the real world, then Lanier comes as quite a shock. He's a man of large proportions and expansive mind, sporting wild shirts and dreadlocks, with a burning passion for music, politics and

business. According to Lanier, television and the movies are about as far as we can push the notion of providing experience without demanding any participation.

"The human being actually has to be active in the world in order to sense it," Lanier muses. "The head is not a computer with little cameras and microphones on it. Rather, the head is like a spy submarine, moving about in the environment performing intentional experiments in order to understand it."

What VR allows us to do is explore inside a digital memory bank in the same way you would explore your home, the bush or the city. You negotiate the three dimensional computer world with your submarine head and your manipulator hand. The difference from reality is that you can defy the limitations of your body and even the laws of physics. You can be as small as an atom or as large as a galaxy. You can pass through the eye of a needle or fly into orbit. Of course, a Virtual Reality experience is only as real as the power of the computer system and the imagination of its programmer, but both of these are expanding as fast as a leech in a blood bank.

So much for the talk - how does it actually work? The system I was using was put together by Jaron Lanier's VPL Research company, housed in a maze of small rooms overlooking San Francisco Bay. Like any other computer system it comes in two parts: hardware and

software. For people who are computer illiterate like me, it's the hardware that's both most obvious and most interesting. Perhaps because you can wear it.

Essential VR couture is the EyePhone and the Dataglove. The first for your head, the second for your hand. The EyePhone is a spacey headset built around two tiny liquid crystal TV screens and a pair of magnifying goggles. It blocks your view entirely. Instead, each eye gets its own 80 degree view of the computerworld: just as your right and left eye does in the real world, so you get a satisfying illusion of seeing in 3D. Stereo headphones supply you similarly generated directional sound. While the EyePhone lets you look and listen, the Dataglove enables you to move and touch. Resembling a high-tech evening glove, it has fine fibre optic threads along the back of the fingers, following the lines of bones. These fibres flex as you move your hand, signalling every move you make to the computer as you make it. In the VPL system, a computer-rendered version of the Dataglove appears in your field of view. In other configurations, a whole cartoon-like body is generated. By calibrating the glove in certain positions you can use your hand to give the computer instructions. A clenched fist allows you to grab objects that exist only inside the computer program, an open fist lets you drop them wherever you want to put them down. If you want to, say, fly across a room, you simply point your index finger like a gun at wherever you want to go and press the trigger – in this case, your thumb.

It was my thumb that seemed to have become kind of uncalibrated. With my glove stuck in "full ahead" I was plummeting deeper and deeper into Seattle Harbour. Instead of hitting the bottom, I travelled clean through it into a grey void beyond. It doesn't matter what the technology, learning how to stop is always difficult to master.

More difficult still is trying to comprehend the half million or so real-time calculations the graphics work stations must be making to be able to update the images for each of my eyes as I look around. The rather angular and cartoon-like scenery leaves me in no doubt that I'm swimming about in a computer and not the real world, but the crude imagery and jerky response to a quick movement are subtle reminders that in this synthetic space, it's the computer that's doing all the hard work.

These worlds don't simply appear when you don an EyePhone. Some poor sod has to build each one, design its shapes and complexities, the physical constraints and forces, the play of light over the scenery – everything that's needed to make a world complete. In essence, each world is an interconnecting framework of mathematical equations and relationships – the data-set – which the software uses to flesh out the view. It's like a very sophisticated 3D version of paint-by-numbers. Position sensors track the location of the glove and the headset, putting them and you in the picture.

Put all this together and it's no wonder you feel like you've actually climbed inside the computer. And this is only the start of your adventures. Once inside, every object or piece of data can be something you can manipulate and move about. Say, for example, you're on an imaginary beach and you don't like where your beach towel is. It's quite possible to pick it up and move it with your imaginary hand. And you don't have to explore alone. If someone else is hooked-up to the same Virtual work station, you can meet them on the same imaginary beach. You can chat them up and even change your physical appearance so you look good in bathers. Some systems allow you to feel the pressure of their imaginary handshake. Getting interested? There's more...

Nothing prevents people hooking up from opposite sides of the country, or even the planet. You could meet as humans, as antelopes or as insects. Rather than slipping on a glove, you can slip into some-

thing far more alluring – a fibre optic leotard that encapsulates your whole body in data-gathering comfort. In the next few years it's likely that these suits will be able to not only feed the computer with positional information, but provide you with a sense of touch and temperature. Small airbags and other transducers built into the suit could relay the pressure of the things you touch, giving you a sense of weight and hardness. Outfits like this already exist in experimental forms.

Certainly, it all sounds quite impressive, and perhaps even a little seductively dangerous. But is it anything more than a rather sophisticated computer game? Absolutely, according to Jaron Lanier. "Ultimately, all progress in science is based on the success that people have in communicating with one another. Science is a social process", he says. "What I believe we can do with this technology is push the envelope of what level of complexity people can understand and communicate about."

This is certainly the direction that most applications of Virtual Reality are headed at the moment. At the University of North Carolina, researchers grapple with computer-generated molecules using a mechanical force-feedback arm which relays to your hand the correct forces of attraction and repulsion that the atomic arrangement is generating. Such a technique gives chemists a first-hand understanding of the stability and viability of new compounds as they try to shove molecules together.

UNC's Warren Robinett is developing head-mounted displays that project a Virtual image in front of the user's view of the real world. Obvious applications are medicine, where a doctor could observe the patient using normal vision and also see an internal feature such as a broken bone, a developing foetus or a tumour, imaged by X-ray, ultrasound and NMR techniques. Treatment and manipulation would be much more accurate, even if somewhat like a video game. Systems are being developed by Greenleaf Medical in San Francisco that allow people to learn to re-use their bodies after strokes and permit cerebral palsy sufferers to work as receptionists.

The design world is also set for a big shake-up. Almost anything can be modelled completely inside the computer as if it were a lump of clay. Parts could be tested for fit, operation and customer satisfaction. When it is time for construction of a prototype, you simply send the modelled data-set to the stereo-lithographic unit and computer controlled laser beams shape a polymer replica in a bath of fluid. There is nothing particularly fanciful about this – simple objects could probably be manufactured like this now.

Architects are using VR to allow clients to walk through buildings before a single foundation is placed. If the building is a kindergarten, you can shrink yourself to the size of a child. If it's a restoration, you can get it right before reconstruction.

These are all solid practical examples, but there are more intangible and abstract ways of putting VR to good use. "I was always frustrated that mathematics seemed to be lost in all the formulae," says Jaron Lanier. "To understand your way around a large city, such as Sydney," he continues, "you have grasped a greater level of complexity than is present in most scientific problems and if we can turn scientific data into that type of experiential data that the human being is optimized to understand, then perhaps we can help people understand information more clearly." Lanier sees direct applications in the world of finance, where large amounts of data may be turned into an abstract forest that you wander through.

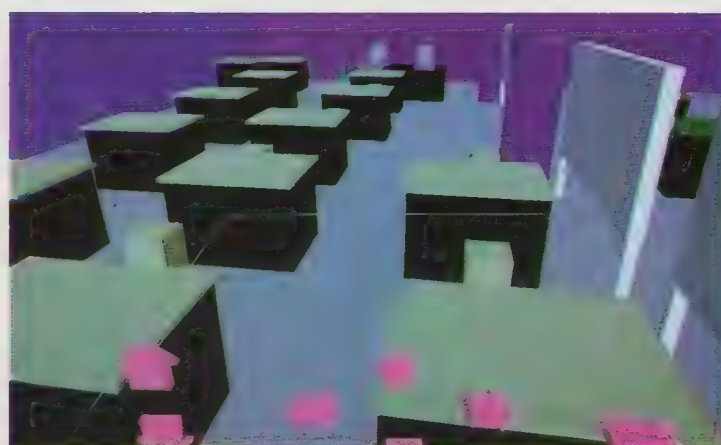
Like so many of today's technologies, it's hard to determine if Virtual Reality was first talked about in laboratories or in science fiction novels. The earliest successful systems were probably those



Virtual Reality in action: All set to dive into datalife.



Virtual pottery: Mould clay without getting your hands dirty.



Virtual design: layout an office without plans.

developed for the US Air Force; the so-called head-up displays that allowed fighter pilots to see the instrumentation in their visors simultaneously with looking out the cockpit. It would be fascinating, and probably a little alarming, to find out what they're dreaming up now.

NASA is one of the hotbeds of VR research. At the Administration's Ames Research Laboratories in Silicon Valley, Dr Michael McGreevy heads a telepresence project which he hopes will allow planetary exploration from Earth. Using data from unmanned Mars missions, the team has rebuilt the Mariner Valley inside their work station. Another nondescript room, another headset, and this time I'm flying over a crude, but faithful, rendition of another planet.

McGreevy talks of a not-too-distant future when we will be able to digitise planets with a very high level of detail, perhaps with a resolution of 5cm or better. His vision: "In 25 years, anyone who wishes to could have a vivid sense of presence on any of the planets that have been explored by man or machine." He cites the elimination of the elitism of space exploration as a major benefit of the technology. "One of the huge benefits of planetary exploration is just the miracle of being able to appreciate that our planet is just an isolated ball in a huge void."

Such a planetary telepresence will allow us to explore those parts of space that are too dangerous or too difficult to do with human bodies. The first contender is likely to be Venus, the current Magellan mission having sent back more detailed surface information for this planet than we have for our own.

Other NASA research is in the related field of telerobotics, where an operator can manipulate a computer phantom of a robot arm that actually exists. Put that robot arm on a space shuttle and you can repair satellites in orbit.

But enough of the benefits and promise, there are obviously some serious concerns with all this stuff. A hazy boundary is starting to open up between the real and imaginary worlds. The distinctions will become even less clear if the full spectrum of senses such as touch, taste and smell become Virtual possibilities. Critics see VR not so much as a path to enlightenment but a road to ruin, taking us into a social wasteland where the weak-willed will spend their days in mindless pursuit of escapism. Or worse – a whole new landscape of perversity, where Virtual rape and murder is commonplace. Every technology we've come up with has been put to sinister use. If we can visit a national park inside a computer, why bother looking after one in the expensive outside world? Many would argue that even a technology as straight-forward as television has led to an enormous erosion of social skills.

"I view Virtual Reality as much more the evolution of the telephone than the evolution of the television," counters Lanier. "The only reason VR is real in the first place is that it's interactive. The moment you remove the power of the person to be in charge of their own experience, then at that very moment you lose the magic of Virtual Reality. What that means is that the users, the participants are in control and it cannot be a broadcast media, it cannot be like television where a central studio decides what people will perceive, it can't be a media with an enforced narrative or an enforced message."

Like it or not, Virtual Reality will soon be coming to a location near you. It's already found its way out of the lab and into the amusement parlour. You could soon find VR lurking in classrooms, in travel agencies and in department stores. The Japanese retailer, Matsushita, is using it to sell kitchens. The system, called Kitchen World, allows people to design their own kitchen, fit it out with a full range of Matsushita appliances and make sure they're happy with the layout before the real item is shipped home to their apartments. It's not a big leap to predict that you will be able to sample your next holiday destination – the room, the bar, the beach – before leaving home.

It's strange to think that in such a short space of time we've come to expect so much from the silicon revolution that we see Virtual Reality as something more or less inevitable. Indications are that both software improvement and refinements in the resolution of liquid crystal television will permit VR images to approach a level of photo-realism – or alternatively allow more images from the real world to be realistically digitised and incorporated. Lanier took me on a guided tour of a Virtual version of a real art gallery in Berlin. The soft modelling of forms, the shafts of light and splashes of colour had come a long way from the chunky harbourscape of Seattle, built only a few years before.

But regardless of further refinements, VR will always remain an illusion. When painters first learnt the techniques of three dimensional modelling and perspective, the effect must have been staggering. No wonder artists like Tiepolo were employed to spend their days painting the ceilings of cathedrals. Likewise, when the cinema first started, patrons were overwhelmed by the way a whole new world opened up in front of them, even if it was only in two dimensions. People screamed if a locomotive roared towards the camera, thinking it would somehow leave the screen and crash into the audience. But humans are remarkably adaptable and we grow accustomed to our new tricks. Every new Hollywood action blockbuster these days has to go one better than the last in order to keep convincing us that reality is being created on the screen. A similar process of acclimatisation is likely to accompany the development of VR. The brain will quickly get used to the tricks and will be demanding more and more from the technology.

In the space of a day in San Francisco, I'd done a lot of exploring. I'd been to the bottom of Seattle harbour, admired artworks in Berlin, and a subway in Potsdam. I'd flown the length and breadth of the Mariner Valley on Mars, and travelled along someone's optic nerve and into their brain. Finally, I'd ventured into a strange little room where a small creature shaped like a beach-ball kept bouncing off the walls and floor demanding to be picked up and then immediately put down again. All this immersion in 'Virtuality' was hard work for a feeble human brain, stretched to its limits, and I was pretty well pooped. I decided to switch destinations and take a plunge into some deep non-digitised sleep.

Richard Smith is a producer on ABC TV's Quantum program.



SPOONER

Why AUSTRALIA needs a PRESIDENT

RICHARD WALSH TALKS WITH TERRY LANE

THE AUSTRALIAN POLITICAL SYSTEM is not serving the nation well, according to publisher Richard Walsh. He has described in detail an alternative system that he believes would serve the country better in the 21st Century. Walsh's ideal government would be republican and would consist of:

- A President directly elected by the citizens
- A Cabinet of appointed, not elected, ministers
- A Parliament made up partly of elected representatives and partly of nominated representatives.

Citizens would choose whether they wanted to vote, as we do now, in periodic elections or whether they would prefer to join together with like-minded citizens to nominate a representative to vote on their behalf in Parliament.

Representatives in Parliament would not have equal votes: their vote would be proportional to the number of citizens who have voted for them or nominated them. And there would not be a fixed number of seats in the Parliament. There would be a set minimum number of seats because no member would be permitted to cast more than a certain number of votes. And there would be a set maximum number, because to be elected a member would need a set minimum number of votes or nominations. But between the two limits the actual number of representatives in Parliament could constantly vary.

Groups from outside Parliament would be able to propose legislation and the Parliament would hear expert testimony for and against the proposed Bill, but would not debate it. The Parliament would be more akin to a court of inquiry, hearing, analysing and adjudging evidence.

Nominators might be able to withdraw their nomination at any time or transfer their nomination to another representative, producing a form of citizens' recall in the system where Parliamentarians could lose their seat if their number of nominators fell below the specified minimum.

In Richard Walsh's ideal system the State legislatures would be abolished and replaced by a larger form of local council.

Walsh says: "The present system does not encourage participation, except by the dogged and the dogmatic; under the proposed system there is the real possibility that participation in our political life would be revitalised and renewed."

ILLUSTRATION BY JOHN SPOONER

The 21•C interview



TERRY LANE

Imagine that it's 20 years from now, and we still have the same political system that we have now. What will it be like? Which is really another way of saying: Why change?

I think I have some imagination, Terry, but I can't believe that there won't be change in the next 20 years. It seems to me that political

life already is in such doldrums I can't believe that our society would tolerate the continual decline in public life.

I'm sure that in the next 20 years there will be a republic in which we change the Governor-General to being someone appointed by Parliament or elected by popular vote. And we might as well face the whole truth, which is that Australia will become weaker and weaker so long as we permit State rivalries. There will always be rivalries, but where we have the petty rivalries between the states and the petty fiefdoms of State legislatures, I feel that something has to be done to get rid of them.

People who say we shouldn't tamper with the Constitution because it's working so well must be living in a different world. I don't see the Constitution as working well, I see it as leading inevitably to grandstanding by State Premiers and great divisiveness at a time when Australia should be getting its act together. And the real questions shouldn't be whether NSW and Victoria can get their act together but whether Australia and New Zealand can get their act together; whether Australia, New Zealand and Singapore can get their act together; whether we're moving towards some Asian economic community, or something like that. It is so old fashioned for Australia to be railroaded by the petty rivalries.

I'm concerned about the quality of people who are attracted to public life. Sometimes when people like me say that it might sound as though what I'm actually saying in code is: "Gosh, I wish public life was more attractive to me and my friends". That isn't the case. I long ago decided that politics wasn't, in any shape or form, what I would like to do with my life, but it appals me that people who I think probably have a part to play, and who are by temperament better suited to political life than I would ever be, don't find it a useful way. Politics is almost becoming irrelevant, and intelligent citizens show no interest in politics. They're alienated from it in its present form, because they feel utterly powerless. They don't feel that their political views fall easily into the two or three compartments that are available. They don't feel enough of themselves is identified by just a label like "Labor" or "Liberal", or even if you start to divide it up into right-wing Labor versus left-wing Labor. There's a lack of identification by people. All of them may well have traditional patterns of voting as I do and reluctantly roll up to the polls and vote a certain way, but do so with no great enthusiasm.

It's time we talked about evolving a system so ordinary citizens like myself, who don't wish to participate in politics by becoming politicians but would like to feel that politics means more than voting every three or four or six years, have some sensible way of making politics part of our lives, like the other important things. I would call this the democratisation of our society, because I think we've become, through laziness, undemocratic in what is basically, in structural terms, a very democratic society. It has become undemocratic through inertia.

Only the people with tremendous energy get involved in the political process, and sometimes that energy can be for the wrong reasons. We see that in local councils, where candidates often have very specific reasons for wanting to stand. The idealism isn't there, therefore they've got barrows to push. And they aren't necessarily the ideal peo-

ple. So from the local councillors to the State Parliaments to the Federal Parliament, I think there's a problem in attracting people as good candidates. Over and above that, there's a problem of ordinary people feeling alienated from politics.

An American political philosopher once said that the ideal democracy – one like ours, for instance, which derives from a combination of Westminster and the American system – is one in which the hoi polloi play only the role of spectator, and that only those who have an enthusiasm for politics should actually play the game.

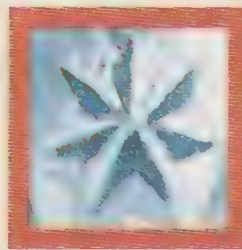
I find that a very unattractive view. I know at times that anyone who is an intelligent observer of the political scene occasionally gets seduced by elitism, and it would be a very attractive idea to believe that only people who show an intelligent interest in politics should have a vote and have power. The real challenge is making ordinary people more politically sophisticated, and making politics itself more interesting and more central to our lives. It's no longer central to our lives. The central things are entertainment, sport, business, for people who are in business; politics, at times, seems almost an irrelevancy.

My kind of Parliament would contain a large number of individuals who were not elected, but who were the nominated representatives of you and me and those who are interested in the political process, and hopefully as it went along more and more people would choose their representative that way. I would have decided somewhere along the line that somebody, Mr X or Ms X, was a person who I wished to cast my vote in the Parliament. And the relationship I wanted to have with my representative could be highly personal. I might actually pay partly for that representative, and as a quid pro quo she might send me a newsletter every month that tells me how she's voted on things, or how she intends to vote on things.

There may be representatives who could represent groups of individuals right round Australia who share a common belief. They might be all Seventh Day Adventists, for instance, who nominate their representative to Parliament. Everyone who's a Seventh Day Adventist in Australia may decide to have somebody who's representing that view in the Parliament. Or my neighbours in Mosman may decide to nominate a representative, so it might be a narrow geographical base. Obviously it's much better if it's narrow geographic because then, from time to time, all the people who that representative represents could actually get together and talk through how they want their representative to vote. Not necessarily on every piece of legislation, but on some things.

Now the legislation comes before the Parliament. There's not a parliamentary debate. There is a proposing of legislation, and the people who've put it forward themselves are the advocates for that legislation. There is expert evidence brought before the Parliament. There is an attempt to persuade the Parliament. I think the present formal parties would exist, and many of those people would represent the Labor or Liberal Party, or what was left of them, but many members would be open-minded people, and the debate would be conducted on the basis of trying to persuade those unaligned people, using both advocacy and expert evidence, to the point of view of the legislation. Of course, there might be amendments placed and all that complicated thing. Those citizens who wished to be more than just passive voters and want to participate in the process through their nominated representatives would have a direct effect on the process because each representative in that Parliament wouldn't just have one vote: they would have a vote equal to the number of people that they either represented or who elected them. And that would be a very fluid situation.

Some people have criticised it and said: "Oh well we're going back to Italy" or something. Yes, it would be fluid. I think it would be more predictable than an Italian situation, because the representatives in Parliament couldn't, in the normal course of events, aspire to higher office. The actual government would come in a different form. Some



of the instability of these kind of Parliaments comes because of the individual aspirations of representatives who want to catch the Prime Minister's eye so that they can become Cabinet Minister or Shadow Minister, or whatever it is.

Anyway, I believe that people would have a fair idea of where the different strands of belief existed, but the debate would be lively, and those who wished to plug into it would do so. And I believe that a significant percentage of the population, I'm optimistic enough to believe up to 20 per cent, would actually have nominated representatives rather than choosing to go to a ballot every three years or whatever. The parliamentary process would be a lot more engrossing, and that's what we need. We need an engrossing, involving political process.

And every citizen would have the right to choose whether she was going to nominate or elect.

That's right.

And one of the things that you've said is that there would be no pre-determined number, no numerical limit on the size of the Parliament. No elected or nominated representative could represent more than x citizens. For argument's sake, say 50,000: I mean, no one could represent three million. We don't want that kind of megalomania. So it might be 70,000, it might be 100,000, but there would be an upper limit to how many votes one individual can cast. There would be a lower limit as well, and there may be a structure by which the taxpayer only pays for representatives who represent, say, a minimum of 20,000. There may be a shadow area where you allow representation of smaller groups than 20,000, but in that case the constituents themselves would have to pay for that representative rather than it being at the taxpayers' expense. But, yes, I mean, mathematically there would be a floating number of representatives, depending on how the votes went, because the number of representatives is immaterial, it's how many votes there are. If every representative obviously represented 100,000 people, then they would get to a different number of representatives than if everyone was voting on behalf of 20,000 or 25,000.

What would be the relative power of the Parliament itself as against the power of the Executive? Presumably there's some way for the Parliament to elect an Executive?

No. There would be a democratically elected President, very much like the American system. A democratically elected President would select his own Executive. It's extra-parliamentary.

So how do the Parliament and the Executive then face off against each other?

Well, obviously there are checks and balances. The President and the Ministry have limited powers, so that obviously there are things, whether it's conducting wars or the budget, that Cabinet can and cannot do, and the legislature is supreme, so that the Parliament is capable of passing legislation that limits the powers of individual ministers. As in the American system there is a balance struck between the executive and the legislature. I believe that the American system in that regard, bearing in mind the role of the Supreme Court in America does work out reasonably well.

Richard Nixon said that for four years, the American president was an absolute monarch. Now that was an interesting insight into how he had seen central government in the US developing. I rather think the French president sees himself that way, too. That would seem to be the danger of a system where you separate the Executive from the Parliament.

Yes. It's funny that Richard Nixon was so powerful and yet he was able to be impeached. Maybe he had the wrong perception of how the American system works and he may have overjudged his powers. I

can't at this stage go exactly into the balance. There's no doubt you can't have a situation where the president, every time he wants to sneeze, has to get the Parliament to approve. There does have to be some strength, and there does have to be some leadership.

The US presidency is strong and fortunately presidents aren't called upon to make war too often, but there obviously have been ways and means by which presidents have got round the powers of the Senate and the House of Representatives in the past by not actually going to war, but seeming to go to war. But in broad terms, it seems to me that George Bush does not act as though he doesn't give a stuff what the Senate and the House of Reps thinks.

There is another problem, it seems to me, in the American system, which is that when you invest so much in the person of the president himself Congress is very reluctant to actually confront the President, even when Congress is controlled by the opposing political party. They don't confront the president and frustrate his will because the President embodies the unity of the nation.

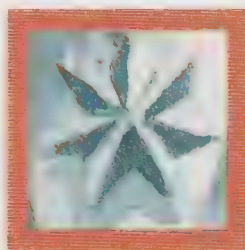
Quite so. That's the American tradition, of course, which has good and bad aspects, as you know. Even the party that's out of power is very reluctant to attack the President.

In the American system there is no concept of a loyal opposition.

That's right. And that even happens in the press. I know the Washington press corps had deep reservations about Reagan's physical capacity to carry out the job, but they all feared the effects of exposing him. Don't forget, they have come through a civil war once, and all other kinds of traumas that we haven't had in Australia. They have this terrible fear that if you attack the presidency, you will divide the nation. They're fearful of divisiveness in America, and that's why there is so much consensus between the two political parties. To us it seems very strange that the political spectrum in America is so foreshortened. They are frightened. They have a consciousness that they live in a very divided country. I think that even talking about race is a taboo subject for fear that if you talk about the problem of blacks in a really intelligent way you're going to destroy the unity of the country. We come from a different, rather more robust tradition, where I don't think we're as fearful of divisiveness.

I mean, even on a thing like religion, Americans argued about the propriety of electing a Catholic president. Kennedy, in 1961, was the first, and that was kind of a big thing, you know. They've not had a Jewish president to the best of my knowledge, yet we've had Catholic prime ministers going back to Lyons, and we've had two Jewish governors-general. I'm not saying we don't have sectarianism, but we seem to ride along rather more comfortably with these things, and there's certainly no tradition here that there's no such thing as a loyal opposition. The press from day one feels entitled to tear away at the Prime Minister. You could argue there's some down side of that, but that's the tradition we're comfortable with, and I don't believe that anything that we can do with the structure is going to change the tradition. Any President of Australia is going to be always up there and being questioned. I believe we can get the right balance, and I certainly am not looking to a president who's a god figure, and I don't think that's appropriate to the Australian tradition, or likely to come through with the kind of structure that I'm talking about. Maybe I'm talking about the balance being struck a little differently from America, but I don't think so. I think what happens in America is more to do with its tradition than to do with the structures. The structure is in place. In theory the Congress can do all kinds of things, including impeach the president. They've been reluctant to do that for traditional reasons.

In your system, the Parliament would not be a forum of adversarial debate, but would be a forum for the assessment of evidence. For it to



work at its best, the parliamentarians would have to be remarkably open-minded. Of course, the nominated representatives may be instructed in advance on how to vote, but the majority would be expected to treat the legislation on its perceived merits. Who presents the arguments? How is the expert testimony brought to Parliament? Can anyone come to Parliament and give evidence, or will only that called by members be admissible?

Well, to take again the example of the Seventh Day Adventists: it may be that everyone who belonged to the Seventh Day Adventist church has a nominated representative, and it so happens that on particular issues Seventh Day Adventists may wish to lobby for a particular thing that they believed in. With enough support, they would be able to have a piece of legislation put before Parliament. It wouldn't be just the representative having the power to introduce a bill for consideration.

There would also be political parties, part of whose responsibility would be as lobby groups, i.e. on particular kinds of legislation, making sure that they had a place at the table and therefore could argue and cross-examine. Those groups may also be trying all the time to mobilise people to support certain slates of nominated representatives, but the representatives as such would not be calling evidence. They may have, from time to time, the power to cross-examine if that seemed appropriate.

So the members of Parliament would be a jury?

Yes, a very big jury. And most of the time you and I would choose someone we thought was a very good listener and evaluator and analyst who had some sympathy with our kind of world view, but who is going to listen. Because those debates would take a period of time, there would be a chance for me to read about the debate in the paper (because political debate would be more interesting the papers would cover them more thoroughly) and whether there were things that had been raised that might change my views.

This would be formalising what Ted Mack, the independent MHR for North Sydney, does informally. When a piece of legislation that he knows is scheduled for debate and vote in Parliament, he can submit it to his precinct groups and ask them how they want to be represented.

Quite so. I live very close to Ted Mack and while I'm not necessarily totally a supporter of Ted Mack's views on things, I see some attractiveness in that. I certainly see that that's a process for making his electorate more interested in politics and more involved. I can't help feeling that without that kind of involvement, we're all sunk.

Australians are notoriously suspicious of ideas, and our current Prime Minister dismisses people who dabble with ideas and concepts as self-abusers, and it seems to go down well with the electorate. So how are you going to engage the electorate in the discussion of an idea that would involve such a radical change to our system? And also there is the Australian notion that if the Americans and British haven't already done it, then it probably shouldn't be done.

On the latter, I think we are a little bit more adventurous than we used to be, but on the former, it's a concern. It's a concern most of all because I certainly don't intend to devote the next decade of my life to this cause. I set it down because it was an exercise to put down in writing what I have thought for a long time. I belong to the Australian Republican Movement. I wasn't terribly happy, necessarily, with every aspect of the launch of that thing, or with some of the people they were thinking of as President of Australia, and so on, but I've been a republican all my life. It's something I have quietly but passionately believed in, but never done very much about, because I never found the opportunity, I guess. It's like the new flag or something. I think one has a lot of beliefs that there's not much you can do about. I'm sure the '90s are very different from the '80s, and I'm sure that there will grow in time a new interest in ideas. I think we've come from a very materialist period in the near past to a period that, lead-

ing up to the centenary of the federation, is a time when Australians will start to be a little more contemplative. I guess I'm predicting that Australians will become a little disenchanted with the system as it exists at the moment, and a little more idealistic than they've been in the past five years. And if, as they become a little bit more interested in ideas, and a little more disillusioned with the system we've inherited, they become receptive to discussing my ideas and other people's ideas, then I would be delighted. I'm always happy to play a part. But I'm not playing a part like running around and trying to start a new movement, or something. I'm quietly predicting that there will be a movement of sentiment in the direction of both ideas, and in the direction of a republic, and in the direction of people being more interested in trying to get the political process right. I'd like to participate in that debate.

The year 2001 is becoming a symbolic year, and it looks as though, on the political right, they're shaping up to defend everything – the flag, the constitution, the monarchy, the whole works – from all those on the left who have said that by 2001 it should all be changed.

Well, I would make a prediction that by the end of next year, there will be a Liberal government and within a few years of that there will be great disenchantment with what it achieves. And that might be the opportunity in history. The present system isn't working terribly well. I think, however reluctant I am about it, I think probably it's going to happen that another set of values, represented by Dr Hewson, is going to have a chance to show its stuff. I don't think people are going to be very happy with it in practice, but I think it's part of the process I'm talking about that they want change. One of the reasons why Hewson will get in is that people aren't very happy with the present system. Sadly, they're going to embrace a lot of changes. I'm not really sure they understand where that all leads to and what kind of world it's likely to create, but it's part of the fact that Australians want change. They're dissatisfied with the present leadership and present circumstances, and I think they want to embrace change. Having embraced the change, they might want to embrace another kind of change – a more idealistic kind of change.



To finish on a pessimistic prophetic note . . . whenever liberal democracies collapse, they collapse into fascism. Historically I don't think there is any case of a liberal democracy in a state of economic and social collapse embracing anything other than fascism.

I know people have from time to time said Australia's capable of being fascist. I think our tall poppy thing will always protect us from that. I think Australians still, sometimes in an ugly form, are very egalitarian. I mean to say, I think the tall poppy thing sometimes goes far too far, but Australians still have an extremely healthy disrespect for authority. It's something which gets us into trouble and sometimes undermines the country, but I think that healthy disrespect will always save us from any form of totalitarianism, let alone fascism. I'm very optimistic about Australia in the '90s, and as I say, I think we are going to find by the end of the decade our place in the world. I think that instead of going towards fascism, there will be a search for new ideas, and those ideas will be more populist, democratic and egalitarian ideas. It's with that in mind that I've put this forward. I see it as in the spirit of where Australia is likely to want to go.

RICHARD WALSH is the chief executive of Australian Consolidated Press and its publisher. He is chairman of the Australian National Commission for UNESCO; a trustee of the Australian Museum; chairman of the Quest for Life Foundation and a member of the publications committee of the Royal Flying Doctor Service.

Walsh is a graduate in arts and medicine from the University of Sydney and was the founding editor of *Oz* magazine in the 1960s and prominent in that decade as a political dissident and all-round gadfly. He was also the founding editor of *POL* and the political weekly, *Nation Review*.

The original article, 'Time to drag government into the 21st century', in which Richard Walsh set out his ideas for political reform was published in *The Bulletin* (June 18, 1991).

Smorgon



ABOVE:

SYNTAL

Underground cable marker made from 100% post consumer co-mingled plastic waste.

RIGHT:

Smorgon Steel's Rolling Mill producing 350,000 tonnes per year of structural steel products from 100% post consumer scrap.

BELOW:

Moulded fibre packaging products made from 100% post consumer scrap.

Waste minimisation and recycling are fundamental premises of efficient manufacturing. As part of the effort to reduce the use of scarce and expensive raw materials, it is often evident that other materials, which have been cast off as somebody else's waste or reject, can be effectively substituted as raw material.

Smorgon, one of Australia's largest privately owned companies, has been at the forefront of recycling based industries for around 30 years. In Australia, Smorgon was the first company to:

- Manufacture packaging papers from 100 per cent post-consumer waste. Smorgon developed technology to allow it to compete with materials which had been traditionally considered as superior.
- Establish a mill to manufacture steel from 100 per cent post-consumer steel scrap. The Smorgon Steel, electric arc furnace-based mill produces more than 350,000 tonnes each year of structural steel products.
- Build and operate a plant to recycle comingled plastic waste into moulded plastic products known as Syntal. The technology involved in this process is very new and Smorgon has made significant

advances in the process technology and in product application.

- Manufacture plastic stretch-wrap film from recycled plastic packaging film, in a process developed completely by Smorgon personnel.

In addition, Smorgon operates other substantial recycling based industries such as: the manufacture of moulded-fibre packaging from 100 per cent post-consumer recycled newsprint; the manufacture, in the US, of newsprint and tissue from 100 per cent post-consumer recycled papers; and until recently a

thinking are key elements in dealing with materials that are variable in quality, quantity and presentation. Close links are established with the sources of materials, so that we can work jointly to educate householders and collectors to continually improve the quality of the recycled materials. In this way, end-product properties can often be made to equal or surpass properties of products made from virgin materials.

The future will see continued emphasis on the improvement of collection systems, so that the maximum use is

made of the inherent properties of the materials recycled, and so that the recovery rates are maximised.

Innovation and process development will add greater value to end products made from recycled materials, thus increasing the penetration of these products into markets traditionally requiring products originally from virgin raw material.

The end result will be further reduction in landfill requirements, the conservation of scarce resources, reductions in energy use and discharges

to the environment and further improvements in recycling economies.

The development of recycling-based industries in Australia is at an early stage in many fields, with major opportunities for development and growth. Smorgon will continue to expand in the field, and will soon commence production in a new plant, using highly innovative technology, where PET from soft drink and other containers will be recycled into non-food containers.

The plant, which will generate almost no waste, will have the capacity to process each year more than 150 million containers which were previously landfilled. The production of containers from 100 per cent recycled PET will keep Smorgon at the cutting edge of recycling technology.



major glass container manufacturing plant, using a high proportion of recycled glass as feedstock, as well as a paper mill in Singapore making packaging papers from 100 per cent post-consumer waste.

Vast experience in the field of manufacturing from recycled materials, and in the establishment and operation of collection and sorting systems for those

materials, has enabled Smorgon to build a wealth of knowledge and skill.

Innovation and lateral



In My picture, I am showing a rubbish bus. It is filled with rubbish, which it is transporting to a nearby black hole. No one drives it, as it is programmed before hand. With this, there would be no more need for smelly garbage dumps.

When the rubbish comes out the other end of the black hole, it is turned into fertilizer, which is put in the bus, and sold to the farmers for their crops.



Why didn't we think of that? One solution to the rubbish crisis by Jane Burns, 11, of grade 5, Templestone Valley Primary, Victoria.

The recycle merry-go-round

Around and around the rubbish goes and where it stops the money grows. That's the theory behind economically sustainable recycling.

BY PETER MASON

Excuse me madam. Do you think that recycling is important?

If you were to ask this question while standing with your clipboard in a shopping centre, I would expect nearly everyone you asked to say yes. If you went on to ask why, the answers would be less positive. We have heard so much about recycling since it became a political issue that most people are now conditioned to agreeing that it must be a good idea.

To conserve the world's resources and reduce waste are idealistic reasons for recycling, but there is also the pragmatic reason that recycling enables someone to earn a living. People have been earning their living from recycling since time immemorial. Glass was recycled in

Roman times and "Cash in a cannon ball" schemes devised by Cromwellian scrap metal merchants probably gave present day Alcoa an idea to develop.

The thing that all historical and most modern day recycling schemes had in common was that someone could make a profit from them. Examples of profitable recycling schemes abound with major industries based on the reuse of metals, glass and paper. These industries have progressively invested in recycling equipment and developed markets for their products over many years and they are continuing to do so.

New recycling industries are being set up all the time. Plastics, con-

trary to common belief, have been recycled for as long as there has been a plastics processing industry. In Australia, significant amounts of plastics from industry rejects were being recycled 30 years ago. Much more recently, plastics recycling projects using post consumer waste were starting to get going. Like any industry, they will need time to refine their collection systems, develop markets, and become profitable.

The needs of politics and the requirements of industry are, inevitably, different. Industries whether glass, metal, paper or plastics, work away steadily at their recycling goals with their eye on profits for shareholders down the track. Politicians, on the other hand, are pushing for immediate recycling targets to meet voters' aspirations, with their eye on retaining power at the next election. Somewhere, there has to be a balance. If politicians force recycling at a faster rate than markets can accept product, there will be embarrassment for all.

Industry and Governments are involved in continuing discussions on the development of waste minimisation and recycling schemes, and rational programs will emerge in time. For now, the public needs to be aware that recycling can only significantly increase based on economics, not altruism. For instance, if the commercial value of collected items is less than the cost of collecting them, then the system can only survive by subsidisation. Such a subsidy can either be a tax on industry, which will pass it on to the consumer as a price increase, or a tax on individuals through government, most likely at a local level.

Being aware of the practicalities of recycling will help us to understand the need to move forward steadily, hand in hand with the industries concerned. Their record is an impressive one by world standards.

Did you know that APM cardboard contains 70 per cent reclaimed paper? This includes the newspaper you put out in your kerbside collections. Australians recycle one in four



More cities are being served by recycling specialists.

of the papers they buy. APM have been leaders in paper collection since the 1920s, and today in Victoria probably half of the paper and cardboard used is recovered. APM claim that Australia wide 37 per cent of all paper products are recovered. This is a classic case of a profitable recycling business which is growing as fast as markets can be found to support it.

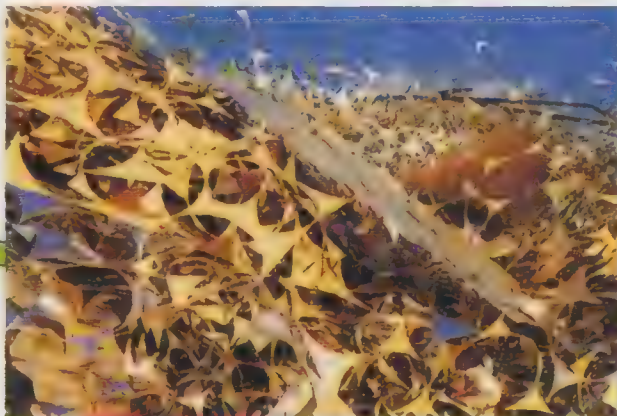
Steel is another success story. Simsmetal recover 95 per cent of all car bodies and over 90 per cent of domestic appliances scrapped in Australia. Since 1973, Simsmetal have installed seven giant shredding plants servicing all mainland states. These shredders feed off flattened car bodies and appliances and produce steel free of contamination, much sought after in world markets. Simsmetal exported ¾ million tonnes of steel last year, greatly assisting Australia's balance of trade.

Glass manufacture started in Australia a century ago, and immediately broken glass was included in the feedstock. Today, ACI glass recycles 25 per cent of its sales tonnage. More than 50 per cent of beverage containers are collected and recycled. ACI has worked

with local government for more than 20 years to develop kerbside collection. Melbourne and Sydney are now fully covered by the scheme and programs are planned for other major urban communities.

Before recovered glass can be fed into a glass furnace it has to be crushed

Tinplate offcuts ready for recycling.



Saving the Earth made simple Adam Cantwell, Grade 6, Templestowe Valley Primary, Victoria, offers an answer.





Glass ready to be transformed.

and cleaned of all contamination like metal caps, food residues, stones and dirt. This is called "beneficiation". The increased supply of bottles from kerbside collections was too much for ACI to process so support was given in Victorian and Queensland and the merchants have now built beneficiation plants in both states. Their businesses are called Recyclers of Australia and Recyclers of Queensland respectively. Both plants are recognised as being second to none in the world. Bottle merchants have invested in beneficiation to value-add to their recyclables collection business.

Did you ever wonder what happens to car batteries once they let you down? The answer is that 95 per cent of them are either export-



Safety comes first in battery recycling at Australian Refined Alloys, Sydney.

ed for recycling or eagerly reclaimed by Australian Refined Alloys, a joint venture of Pasminco and Simsmetal.

ARA's recovery plants in Sydney and Melbourne processed over two million batteries in 1990-91 yielding 16,500 tonnes of lead. As well as recovering the lead, the plastic battery cases are granulated and turned into recycled plastic moulding compound by Simsmetal. Much of this compound is used by Reln Plastics in Sydney for the manufacture of septic drainage systems, including the tank itself. At 56kg this is the biggest plastic injection moulding made anywhere in the world, let alone the biggest in recycled plastic.

A new generation of recyclers is emerging in response to public expectations, rather than because their proprietors see an immediate profit opportunity. These include ACI Petalite which is now turning PET bottles into PET pellets and flake at its Wodonga plant. ACI Petalite,

with support from the carbonated soft drink manufacturers, is now recovering 16 per cent of the bottles it makes. This figure will be more than 25 per cent by the end of 1991. Markets for the recycled PET material include non-food grade bottles, domestic and export sales of PET film and fibre manufacture development.

ICI Plastics with their "Re-Vinyl" program, in which used vinyl bottles are ground to powder and incorporated in material to make new bottles, and B F Goodrich Chemicals are both

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underwriting recycling programs for vinyl packaging, notably fruit juice and cordial containers.

The biggest problem for both PET and vinyl recycling is the cost of collecting the lightweight containers. We need to convert our one bin into two. In the longer term, a proposal by Otto Waste Systems is for single manned collection vehicles with robotic arms that empty recyclables into one compartment and garbage into another. The recyclables are later sorted on a production line.

Pacific Waste Management also have a recycling program in conjunction with Telecom. BP service stations have collection bins for old telephone books which Pacific Waste then take to the paper reprocessor.

Where to for recycling in the 21st century? I predict a steady, rather than dramatic, increase, with the development of more efficient collection systems and the education of the public to the need to conserve resources. While some recycling will be done for political reasons, basic economics will still determine whether waste materials are recycled, including burning for energy, or whether they are landfilled.

More efficient collection systems will mean that more metal and glass packages will be recovered. These industries can use as much recycled stock as can be economically collected. However curbing the tonnage of recycled glass and metal containers will be further developments in reducing their weight and continued substitution by plastics and paperboard containers.

In case anyone out there is asking why we should allow the substitution of metal and glass containers which can be readily recycled, by plastics and paperboard which are harder to recycle, I should explain. These days, our essential packaging needs are subjected to Life Cycle Analysis (LCA) this is a new science developed to measure the environmental acceptability of a product in terms of the amount of the worlds finite resources required to manufacture, distribute and dispose of it. Methodologies for measuring LCA's are now available through the Victoria University of Technology's Packaging Centre at Footscray in Melbourne. LCA's show very clearly which materials are the most environmentally friendly for a given application and will do much to refute well intentioned but inaccurate marketing claims by some product manufacturers. Substituting LCA science for emotional judgement where recycling is concerned, will also encourage sound political decisions.

A hoped for effect of improving collection system efficiency will be to enable plastics containers to be recovered at a price which allows them to be economically recycled. At this time the recycling of used plastic containers is the province of international firms wishing to demonstrate environmental acceptability. None of the smaller firms making a living from recycling industrial plastics waste have yet been able to justify the investment to process domestic waste.

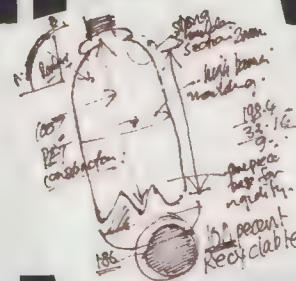
Paper recycling will increase significantly with the introduction of de-inking plants for newsprint and the specifying by governments and authorities of recycled paper wherever it can meet quality requirements.

The price of landfilling will increase as suitable sites become further away from where the rubbish is generated in towns and cities. This will encourage new industries like concrete and demolition waste recycling and the composting of park and garden wastes. The recycling of traditional materials will also improve as councils see the financial benefits of reducing the tonnage of waste sent to increasingly distant landfills.

I have tried to show that recycling is really more to do with practicalities than politics, but just now politics are the major influence. If politicians can keep their jobs by being seen to promote recycling, even if it is not economically viable, they will. As the level of knowledge about Life Cycle Analysis spreads through our education system, so politicians will find another cause to help them keep their jobs, and recycling will once again be all about practicalities

Peter Mason is a consultant in environmental affairs and recycling. He is conference co-ordinator for the Recyclex Exhibitions.

In 1985 it was an idea.



Genetic Engineering

BY DAVID MUSSARED

The genie is out of the bottle, so will your wishes come true?

In the next 10 years, genetic engineering will touch your life. You will use something, eat something or undergo a treatment of some kind which is only possible because of this new, fascinating technology. Some of Australia's best scientists are working at the forefront of genetic engineering. Probably half of the CSIRO's 35 research divisions are making use of it in some way. Already Australia has contributed to the world's pool of knowledge through breakthroughs like the CSIRO's "gene shears".

But where is the Australian public interest in this new frontier of science? In Europe and north America, there has been questioning, controversy and to some degree reconciliation in a highly charged public debate.

In Australia there has been only an occasional, haphazard outburst of publicity about genetic engineering. Usually it is a breathless description of its benefits, devoid of any real understanding, or a blind and ill-informed broadside at the technology as a whole.

So far genetic research in Australia has been controlled through a voluntary, Government-appointed body of experts, the Genetic Manipulation Advisory Committee (GMAC). But the whole issue is now being reviewed by a Federal

Parliamentary committee.

So what exactly is this new technology? What does it promise and what are the risks? Who is making up the rules? Who is the umpire?

Changing plants and animals to suit humanity's needs

Genetic engineering is really nothing new. Farmers have been doing it for thousands of years. Farmers choose plants and animals with desirable qualities - such as high yield or fast growth - to breed their next generation.

That's how humanity came by all its livestock and crops. Modern breeds of cattle, sheep and poultry have all been "genetically engineered" by generations of farmers; so have wheat, rice and tomatoes.

But the past 30 years has seen a revolution in science, linking biology and chemistry in a new technology which can reach into an organism's cells and change some of its genes in one generation.

Genetic engineering means manipulating genes; adding genes from other organisms, removing genes or stopping them from working. The technology is a natural offspring of the greatest biological find this century; Francis Crick and James Watson's discovery of the double helix molecule in 1953.

How any living organism looks and behaves is determined by two things; the genes it inherits from the previous generation and what happens to it during its life. Crick and Watson found that the genetic inheritance side was controlled by the arrangement of small molecules - like letters in a code - which fit like rungs in a ladder along the long, winding double helix of a much larger molecule called deoxyribonucleic acid (DNA).

They had discovered the recipe book used by nature to make all the organisms on Earth. It was written in an unknown language along the spine of the double helix molecule. Other scientists have since learned the language. They have deciphered a few of the recipes and they are learning how to change some of the ingredients. The benefits of such technology are truly breathtaking, but the risks are real.

From barren bunnies to shaggy sheep

Scientists at the CSIRO's Division of Wildlife and Ecology believe they might be able to make nearly all Australia's feral rabbits sterile, humanely ending the rabbit problem in a few years. Since it was introduced in the 1950s myxomatosis has spread throughout Australia's feral rabbit population. But time and evolution have weakened it. Today most rabbits catch myxomatosis, but not all are killed by it. The rabbits which survive breed quickly and recover, and their offspring are even more resistant to the disease.

So the scientists want to add something else to these weaker strains of myxomatosis virus; a gene to stop the surviving rabbits from breeding. The research is four or five years away from being tested in the field. There are two main challenges; finding and inserting the right gene, and making sure the modified virus will not infect other animals.

Similar techniques might also be used for foxes or other feral animals which are threatening our native species and spoiling our parks, crops and pastures. Of course, it might not work. There are many hurdles yet facing scientists. But in theory, it should work. And in theory, it should be safe.

Each year, Australia's cotton industry spends some \$100 million spraying its fields with pesticides to control a destructive moth pest called the cotton bollworm (*Heliothis*). That \$100 million represents more than 10 per cent of Australia's annual cotton exports.

Obviously a new, cheap and more environmentally friendly way of killing the moths would be a boon. The CSIRO is experimenting with adding a gene to a non-lethal virus which normally infects the insect. The extra gene will turn the virus into a fatal disease for bollworms.

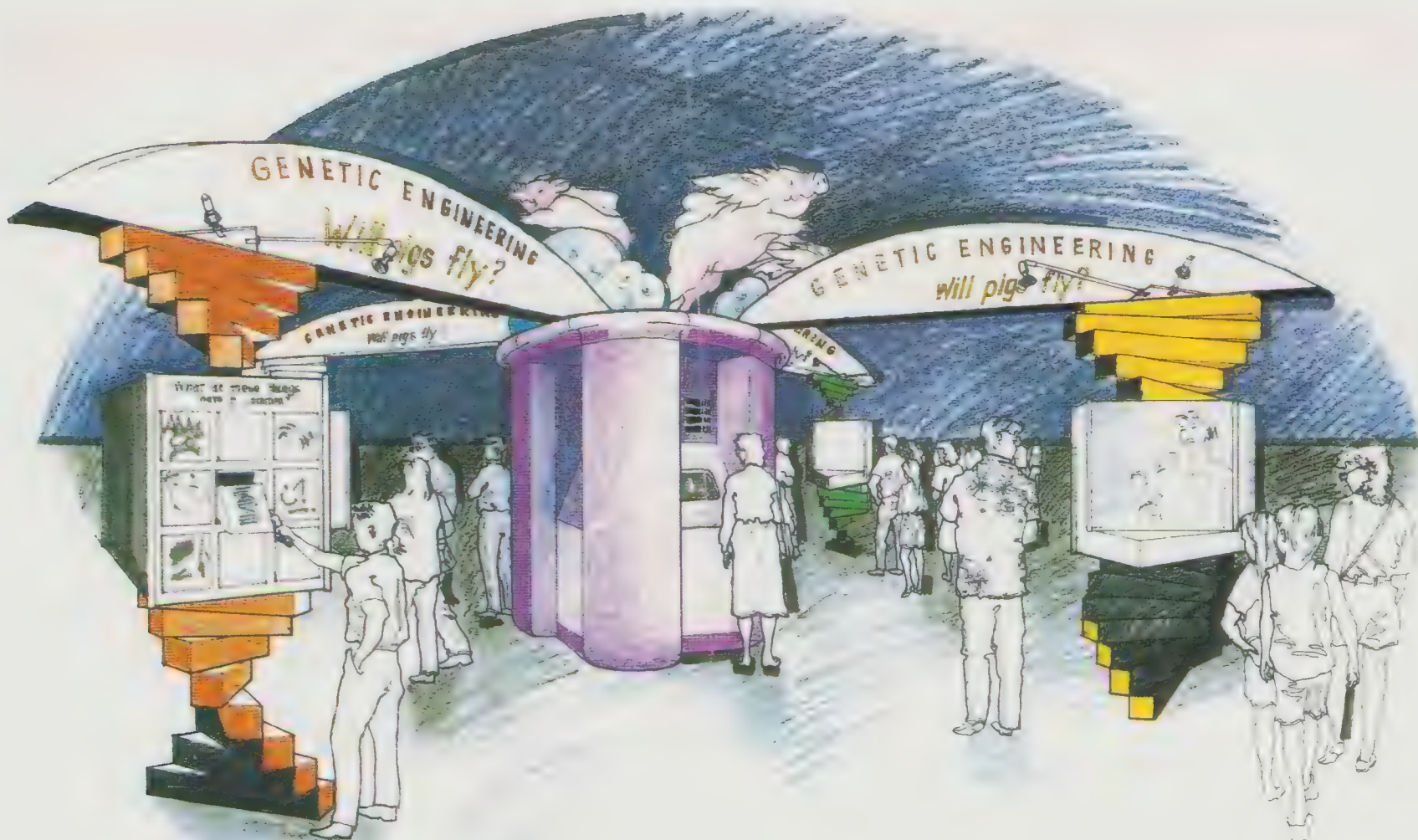
Early results show that the changed virus would attack only bollworms and their close relatives. Using it would avoid the indiscriminate insect-slaughter caused by spraying with pesticides. The genetically modified virus should also be much cheaper than chemicals.

Another method, also being developed by the CSIRO, is to genetically change

BELOW

One new CSIRO vaccine will offer protection for poultry from infectious bursal disease





*What is genetic engineering? What impact will it have on our lives?
What issues must we confront?*

You'll find out at the exhibition:

Genetic Engineering: Will Pigs Fly ?

which will tour Australia in 1992-93.

This lively exhibition provides the basic information on how genetic engineering is done and what work is now in progress. It features computer games, video interactives, exploratory panels and 3-D models. You will be able to explore the ethical and social issues by touching a video screen to see the views of prominent Australians and



then register your own opinions!

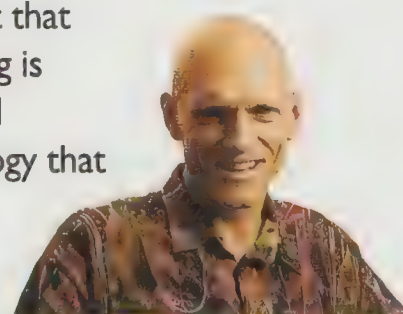
For further information and tour details, contact: CSIRO Film & Video Centre: phone (03) 418 7284, fax (03) 418 7439.

The exhibition is sponsored by CSL Ltd, the Department of Industry, Technology and Commerce: (Science and Technology Awareness Program and Biotechnology Committee), Australian Cotton Foundation, Cotton Research and Development Corporation, Cotton Seed Distributors, and CSIRO Australia.

An education kit containing two videos, a student activity book, a book of readings, a brochure, a poster and a double helix model is available from CSIRO Publications (314 Albert Street, East Melbourne, 3002; phone 418 7217; fax 419 0459) for \$125.

"There's no doubt that genetic engineering is the most powerful biological technology that we've seen yet ... "

Peter Garrett
Singer/Environmentalist

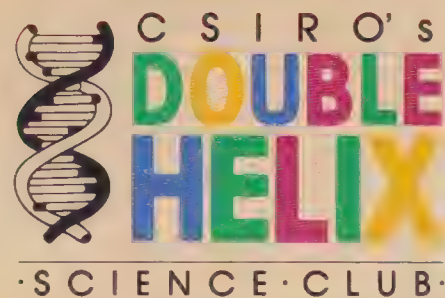


"We fear the power of the technology but we also get that wonderful feeling of excitement about the change that it could bring about."

Carmel Travers
Television Journalist



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In the latest issue: the genetic engineering research that has produced pest-resistant cotton plants

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the cotton plants themselves to make them poisonous to the bollworm. What about adding a gene which will cause sheep to grow more wool? Or one to make pigs or other livestock grow twice as fast? Both projects are now being researched.

Genetic engineering might also be used to breed bacteria which feed on toxic waste and break it down into harmless substances. It might be used to breed crops which copy the pea plant and fertilise themselves by fixing nitrogen from the air. Manipulating genes is already bringing us new drugs, and it might one day make possible the dream of beating cancer, AIDS and many other human illnesses.

The CSIRO and the University of Adelaide are working with a US-based company to test an Australian discovery which promises a revolution in making drugs to treat muscle-wasting diseases. The scientists add a gene to a common bacteria so it will make the drug for them. They then breed a large population of the genetically engineered bacteria in a fermenter and later extract the drug.

The potential of such technology is enormous. Genetic engineering offers hope for safe, clean, highly profitable industries in agriculture and manufacturing. But with the new technology come new risks, and new ethical dilemmas.

In future, will we have copyright cattle? Will agricultural and research companies be able to buy and sell the rights to laboratory-created life-forms such as super-pigs, super-sheep or super-chooks?

And is buying a patent on a genetically superior animal really anything new? Farmers now charge substantial amounts of money for the services or semen of stud bulls, rams and stallions. They "own" the generic material they have engineered by careful breeding, and they sell it at a considerable price.

Similarly, many seed companies now sell only hybrid seeds to protect their market. Plants grown from hybrid seeds cannot breed, so the customer must come back each year to the seed retailer and buy another batch.

So if ever you have paid money for a thoroughbred pet or for a packet of hybrid seeds you have really paid royalties for a copyrighted life form.

And what about the risks involved? Is there any danger the changed viruses could migrate from rabbits or foxes into other animal populations – kangaroos, sheep or even people?

Is there a danger the genetically modified cotton bollworm virus could attack other insects? That it could somehow escape into the insect kingdom which is so vital to maintaining every other life form on Earth? That is where GMAC comes in.

Who decides what the scientists can do?

The 19-member Genetic Manipulation Advisory Committee is a Federal Government advisory committee with no legal force. The science community has agreed to let it guide all experiments involving genetic manipulation. Compliance with GMAC is voluntary.

GMAC is made up largely of scientists, but also includes Phillip Toyne of the Australian Conservation Foundation, two engineers, a lawyer, a public servant and a philosophy of science professor.

The whole question of how genetic engineering should be controlled in Australia is now being reviewed. The Federal Parliament's House of Representatives Standing Committee on Industry, Science and Technology recently finished its hearings into the issue, and is expected to report back to Parliament with its findings later this year.

One of the major submissions to that inquiry came from the CSIRO, which is the leader in Australian genetic research. The CSIRO's submission suggested that GMAC should be kept, but that it should be given some real teeth. The CSIRO said GMAC should be given legislative backing, and that the public should be more involved in discussions and decisions about genetic engineering.

The CSIRO also said it would do what it could to raise the level and quality of public debate in Australia about generic engineering. The research organisation is now preparing a large museum-style display to travel around Australia.

What about genetically engineered people?

Aside from the environmental risks of genetic engineering, how will we decide what is fair game for meddling with and what must be left alone? Should people be genetically engineered? In theory, there is no reason why scientists can't manipulate human genes as they do animals. They are all made of the same stuff.

There is no research in Australia into breeding "better" people. The twin spectres of Hitler and Frankenstein are lessons enough in the danger and foolhardiness of such pursuits.

Human generic engineering is restricted to changes which are not passed on to the next generation. This is known as "somatic" manipulation. It is still at an early stage, but trials of the technology are now beginning overseas.

Unlike "germline" genetic engineering, somatic manipulation works only on individual organisms, not their descendants. It means changing the genes in some body

some body tissues, such as the bone marrow, to cure a disease. These changed genes are not passed on to the next generation.

Germline manipulation changes the genes throughout an embryo, including its sex cells, so the adult organism will pass on the changes to its offspring.

A CASE STUDY:

CSIRO's genetic engineers take on rabbits and foxes

Dr Michael Holland leads a research team from the CSIRO's Division of Wildlife and Ecology. The team wants to do an experiment using genetic engineering.

The experiment is one small step toward possibly one day ridding Australia of its plague rabbit problem. He is in constant touch with GMAC, which will decide the proper security conditions for the experiment.

The researchers want to put a new gene into a strain of myxomatosis virus. The gene will cause the changed virus to make a harmless protein called ovalbumin. If the virus will make ovalbumin, it means its genes can probably be changed to make another, more interesting protein. That more interesting protein already exists in the sex cells of all male rabbits. It is normally found in the head of each rabbit sperm cell. The protein helps the sperm burrow into the female's eggs and unload its half of the genes which make up the next generation's inheritance.

That is the ultimate plan. One of Dr Holland's colleagues, molecular biologist Dr Ron Jackson, will slot an extra gene into the myxomatosis virus so it will make the sperm-burrowing protein. Female rabbits infected with the changed myxomatosis will detect the protein and make antibodies against it. Next time she mates, each female's immune system will recognise the foreign chemistry of the sperm and send in the antibodies. The antibodies will stop the sperm from reaching or fertilising any eggs.

In effect, the scientists will have made the females "immune" to sperm – their bodies will treat it like an invading virus and will attack it. Actually it is more complicated than that. The scientists may choose to use more than one of the several sperm proteins they are now testing, and the modified virus will probably also infect male rabbits and make them less fertile.

If it is eventually released, the CSIRO virus will not stop every rabbit in Australia from breeding. But it could reduce their numbers to a sustainable level, and stop the population booms which cause rabbit plagues and all their attendant agricultural and environmental problems.

If it works, the modified virus will have a double-banger effect. First, the myxomatosis virus will kill 70 per cent or so of the rabbits it infects. The survivors – which normally would breed rapidly and make up the numbers again – will instead have their breeding severely hampered by the new gene in the virus.

But it will be one or two years yet before the CSIRO researchers are ready to begin experiments with putting the new gene in the virus, and probably four or five years of securely "contained" experiments before they will be allowed to try it outdoors.

At every stage along the way, the scientists will seek approval from GMAC for the next step. The committee will judge whether each planned experiment is contained enough and how far it is allowed to proceed before it is reviewed again.

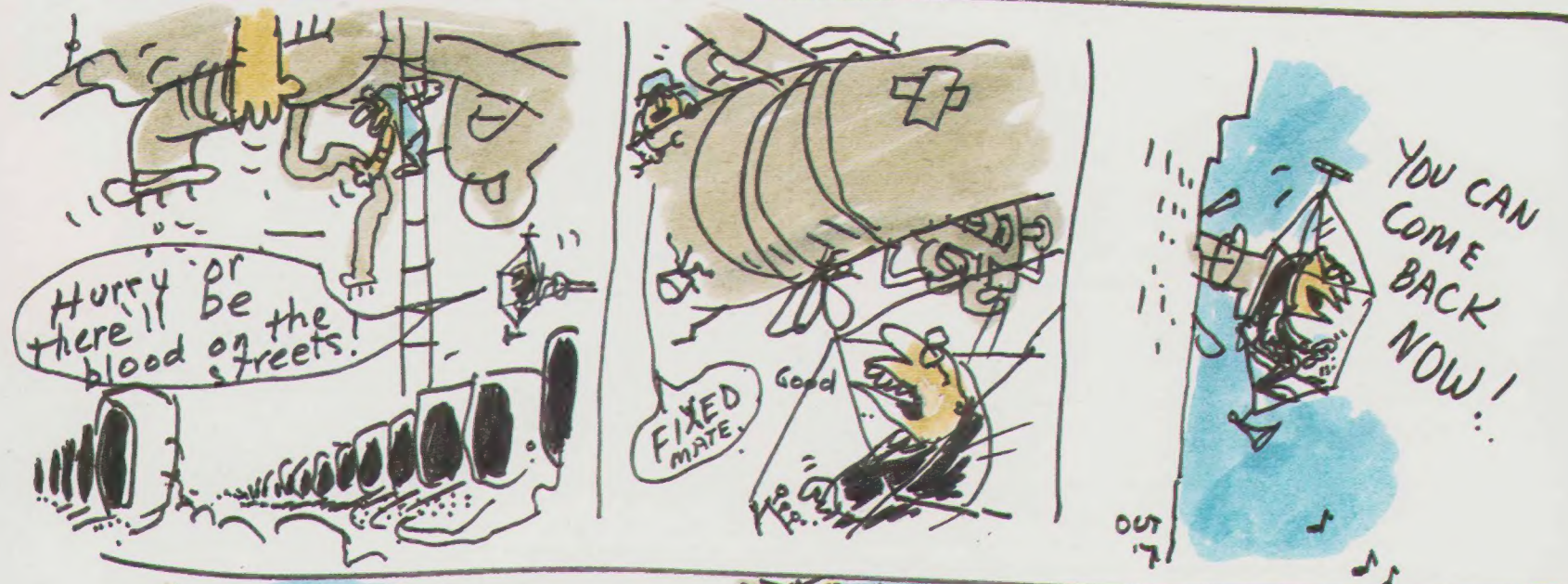
But there is more to the research than just a plan to release a genetically modified myxomatosis virus on Australia's rabbit population in five or six years. If the number of rabbits in Australia suddenly crashes, what will happen to the foxes which live on them? There is a danger that as rabbit numbers crash, foxes will turn to endangered native animals for food instead.

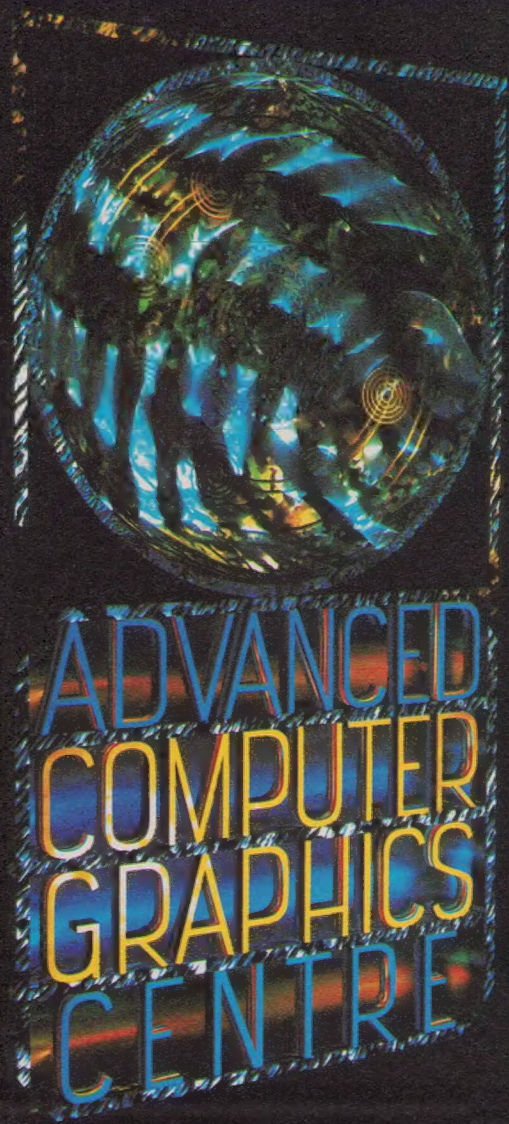
That's where Dr Mark Bradley comes in. Dr Bradley is part of another team, also with CSIRO's Division of Wildlife and Ecology in Canberra, which is working in parallel with the rabbit researchers trying to achieve something similar for foxes.

The Australian public, through GMAC, will have to decide in the next few years whether safeguards are adequate and whether the sterility-causing virus should be released into the wild.

There will be many similar decisions to be made. Each case is different. Each has its own promise of benefits, and its own scale of risks.

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